American Machinist

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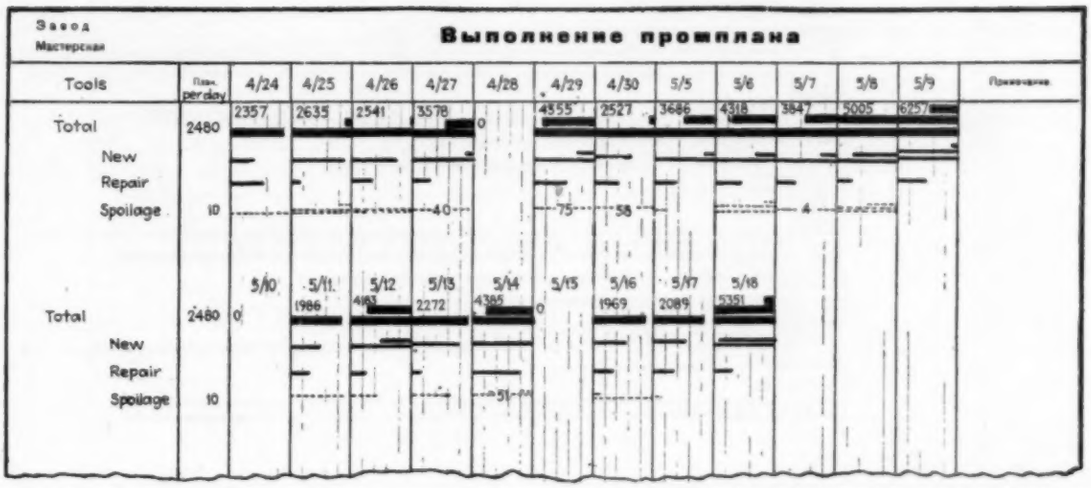


Fig. 1—Progress chart of the tool department. In three weeks after installing the charts and the methods made necessary by them, there was an increase of 23.3 per cent. The English terms have been substituted in editing

The Gantt Chart in Russia

WALTER N. POLAKOV
Consulting Engineer

Everywhere the same problems confront management. Planning, visualization and functionalization are the three important essentials

AFTER the five-year plan—what? Such seems to be the question that interests everybody outside and inside of U. S. S. R. That we shall hear of the completion of the gigantic construction task contemplated by the plan, even ahead of the time set, there is little doubt. But the old truth that a large plant and perfect equipment is of little avail without good management is as true in Russia as elsewhere in the world. How will Russian production measure up with her plants and equipment? This is, of course, a matter of conjecture. Russia has thrown into the waste basket too many wishful prophesies, and leaders of that country are fully cognizant of the fact that last year's production did not measure up to expectations. For the last year the plan prescribed 31 to 32 per cent increase; instead, some 25 per cent increase was attained officially. This year, on the assumption that the five-year plan will be completed in four years, the prescribed increase of output is 41 per cent.

Obviously, this is a problem for management; neither automatic machinery nor the best trained workmen can carry on production without competent leadership directing efforts, planning production, securing materials.

It has been the writer's good fortune to test the existing facilities, to demonstrate the possibilities and to disclose the handicaps besetting the infant industry of the Soviet Union. The plant selected for the experiment, by the officials of the Supreme Economic Council, manufactured precision machine-tools as well as cutters, taps and dies and also a full line of standard metal-cutting tools. It employed over 5,000 workers, and was comparatively new and well equipped with modern American and German machine tools. The number of parts entering the main product was about 200 and the number of consecutive operations on each varied from 10 to 70.

On the first visit to this plant, it became obvious at

Fig. 2—Input-output chart, which illustrates the inequalities of output and the unbalance of finished stores inventory. Bad as it looks, it varies very little from the finished stores in many American factories

a glance that, despite the rigidly prescribed monthly output, the production was behind schedule. An hour's walk through the shops presented a picture of great activity lacking systematic direction; a large number of machines idle, allegedly due to lack of tools; piles of semi-finished parts obstructing access to working machines; men waiting in lines to exchange tools or bunched in groups busy talking; shelves in the tool storeroom overloaded with some tools and completely devoid of others; inspectors' booths and benches buried under parts for examination and rejected work; stores of finished parts short of some parts and overstocked with others; assembly shop starved for work.

There was no doubt that planning, scheduling and despatching were the things needed most, and in the afternoon we made this suggestion, at a meeting of the directors and engineering staff, only to learn that, in their opinion, this is not at all essential and that what may be a good practice in U. S. A. will not work in U. S. S. R.

However, since the consensus of opinion was that only the shortage of tools stood in the way for living up to the task, we turned our efforts in that direction. The existing practice was that every foreman scrambled for the tools he needed in his department, while the tool department manufactured what was estimated by the annual budget, irrespective of the actual irregular tool consumption. To straighten out the matter, we recommended: Take an inventory of the tools on hand, place orders with tool department for the missing tools and establish "Order Points" and "Amounts to Order" for each number of standard and special tools, so that whenever the supply of any tool reaches the safe minimum, i.e., order point in the tool storeroom, an order for a predetermined amount is placed automatically with the tool department. In this manner an orderly and continuous supply of tools for all manufacturing departments was assured.

In the course of this preliminary reorganization, it became evident that the grinding and polishing shop was falling behind the rest of the tool department. This offered an opportunity to introduce a Daily Order of Work, prepared a day in advance by the foreman, and to start in the grinding shop a dispatcher, who was aided by a layout chart graphically representing scheduled jobs for each machine and the progress made on them.

Before this reorganization of the tool department was completed, the Red director (general manager of the plant) was convinced of the practical value of the layout charts and with his support we improved the record keeping to such an extent that we were able to start all machine shops, manufactured parts stores and, in the assembly department, machine record charts, man record charts and progress charts.

Alibi

As we anticipated, the number of idle machines did not decrease with the improved tool supply, but, instead of the symbol for "lack of tools," the short bars on the charts bore all sorts of other explanations. At the same time, the man record charts continued to indicate great fluctuation of daily output per man, and progress charts continued to show that the task was not lived up to, although the shortage of tools was admittedly no longer the cause nor the excuse.

Progress charts, kept in each department for each part and for every operation, showed, in the most convincing

way, the real cause of small production. While some parts were manufactured in quantities far in excess of the planned requirements, other parts were so much behind the schedule that the assembly department was demoralized.

Further study of the situation brought about the realization, on the part of the management, that it was due not only to the fact that the piece-workers insisted on working on better paying jobs and refused to work on the jobs with inadequate piece rates, but also that the foremen and the production superintendent were virtually lost in the mass of detail and thousands of individual operations, and with no amount of superhuman intuition were they able to tell what to do and when to do it. Thus completing our diagnosis of the main ill, we proceeded to demonstrate the shortcomings, as disclosed by the Gantt method of charting, to the foremen and minor executives, both individually and at their production meetings, until their suspicious and supercilious attitude gradually gave place to a better understanding and caused a real concern among the more ambitious.

Graphic Control of Production

At length, the management, fully convinced of the value of such daily planning of order of work and of the advantages of the graphic control of production as installed by us, issued, with typical vigor, the following interesting order:

"For the purpose of installing a new management method, in this plant we have invited an American expert, Walter Polakov.

"At present, under his direction, the work is started to introduce the Gantt charting method as well as to reorganize the record keeping and to tie it up with production processes.

"The aim of the charting method is to show clearly what is going on in the manufacturing departments, what is behind the schedule and why, focusing the attention on the weak points and permitting the prevention of shortcomings.

"Considering the extreme overload of the executive and engineering personnel of the plant, charts save time and show at a glance where an executive should concentrate his attention, not losing himself in details.

"Displaying the charts in the shops for the inspection of workers, shows them how the budget and the plan are carried out and at what speed.

"All charts have one fundamental aim: *To show the time-rate of living up to the plan.*

"However, from the beginning of this work inadequate co-operation on the part of the executive and engineering personnel was pronounced and is still noticeable.

"All heads of departments and foremen are hereby informed that, alongside with other steps towards the reorganization, I propose to install in the production departments of this plant this new system of records and control.

"In order to avoid duplication of effort, any measure, whether proposed by the engineering department or any other department, must be brought in accord with those of the consultant, Mr. Polakov, and, upon approval by the director, must be lived up to; at the same time, when new records are introduced, the old forms shall be abolished.

"During the installation of this method, it is expected that everyone coming in contact with this work will render full cooperation and show active participation in this undertaking. At the same time, the control must be installed from top to bottom, demanding clean-cut work from every subordinate member, using for this purpose the charts. Be it known that from now on I shall check up the production by means of these charts myself.

"The entire record and cost keeping shall be revised and changed in accordance with the new method, and the administration of departments and shops should be guided accordingly.

"I also give warning that any resistance to the installation of this scientific method of work and particularly to the inauguration of charts, records and costs, will be decisively dealt with by me no matter where the resistance comes from."

At the same time, in line with our suggestions, the engineering department standardized the operations, simplified manufacturing operations and designed special jigs. Parallel with this work, efforts were made to so organize the mass production of parts that they may be used interchangeably. This, in turn, necessitated the reorganization of the assembly department. Formerly each part was fitted by hand for each particular machine; now all parts delivered to the store room are issued to the polishing shop where precise dimensions are secured on special grinding machines and the groups of parts are then assembled into a number of aggregates which, in turn, are issued for final assembly when and as required.

For the purpose of planning and control of production the most useful chart proved to be one called the "Input-Output" chart. For every part there is a double line where bars are drawn representing at once the quantity and the time of receipt and of issue of each. A glance at this chart discloses which parts are overstocked ("in" line longer than "out" line) and which are delayed in production ("in" line behind the date).

The antagonism which was in the beginning quite manifest, due to the fear that incompetency and mistakes would be exposed, gradually disappeared as it become obvious to all foremen, department heads and engineering staff that it was easier for them to avoid mistakes and tangles by watching the charts than to cover up the mistakes and to invent "objective" excuses for various shortcomings.

Expecting Miracles

We began visiting this plant for consultations the end of March. The tool department began functioning according to our plan by May; record-keeping system was revised during April and May and began functioning by July. We divided our time between this plant and our other consultations for the Supreme Economic Council, making periodic trips, in the car furnished by the headquarters for our exclusive use, and remaining 5 to 10 days at the plant to check up the progress made and to devise the next step and to make sure that at least a few men understood what was to be done. We were provided in the factory settlement with a three-room apartment, a cook and a food card. Our last visit to the plant was in the middle of September. The entire period of consultations and installation of the new method of management covered some six months.

Perhaps the greatest difficulty in work of this nature in U. S. S. R. is what a vice-president of the Supreme

Council of National Economy, Com. Mejlauk, called: "A passive, ugly, oriental expectation of miracles from the new equipment instead of immediate organization of matters today. This is just the thing which handicaps the fulfillment of the plan this year and finds its explanation in the endless talks concerning the marvels of future reconstruction."

The next handicap is the one regarding which everyone, from Stalin to the messenger girl, talks—the lack of personal initiative and responsibility or what is called in Russian "edinonachalie"—one-man rule. Habitual conferences, indecisions and passing of the buck are doing much to slow down progress.

Lastly, a serious obstacle to good management of Russian plants lies in the hazy, indefinite scheme of factory organization. There is no distinct line of authority or functional division of responsibility, which results in a rather sad state of work-discipline throughout the shops.

Lack of engineering skill, shortage of men experienced in technical processes and even wilful sabotage are often referred to by both Russians and foreign visitors as the greatest handicaps. Our personal observations make us believe it to be of secondary importance, since with the clean-cut managerial principles and simple mechanism of planning and control, given for instance by the use of Gantt's method, most of the mistakes of inexperience and causes of failure are immediately brought to light, remedy suggests itself, and improvement follows rapidly with attending accumulated experience.

Results

The value of results attained in the described plant by this method can best be expressed in the words of its director, who, on the occasion of the First Congress of Industrial Executives last February, reported in part as follows:

"Reconstruction of the industrial management is one of the foremost problems before us. Correct organization of engineering and production supervision is a big task. The director must know every day where, in what particular department he must go first to forestall the shortcoming and to secure the normal flow of work. . . In order to have before him a clear picture of running production which would permit him to direct his attention where it is most needed, every director in industry must have chart records. The importance of Gantt charts is not appreciated by many executives, and that is too bad. The experience of our plant demonstrated its most important advantages. The workers of this plant are warmly recommending its application in all enterprises in U. S. S. R.

"Our experience also proved that the tools must be made not directly for the consuming shop but for the store rooms. . .

'The importance of introduction of correct record keeping and sound organization of the tool department appears to some executives as debatable. I take this opportunity to state that good results of our work during the past quarter and during the past year are due largely to just these two causes.

"The results are indeed good: During 1929-30 cost of production decreased 20 per cent; use of tools reduced 23 per cent. During the special quarter, Oct.-Jan. '31 the plant's output was equal to the output for the entire 1929-30. For 1931 we accepted a program four times larger than that of the last year. The introduction of the Gantt charts alone produce an annual saving of one million rubles."

Later on, in April, 1931, at a meeting of the Business Club in Moscow, a paper was presented on the further progress by the management at that tool plant and the official statement was produced that the output was being maintained at a rate well over 400 per cent in excess of the past record.

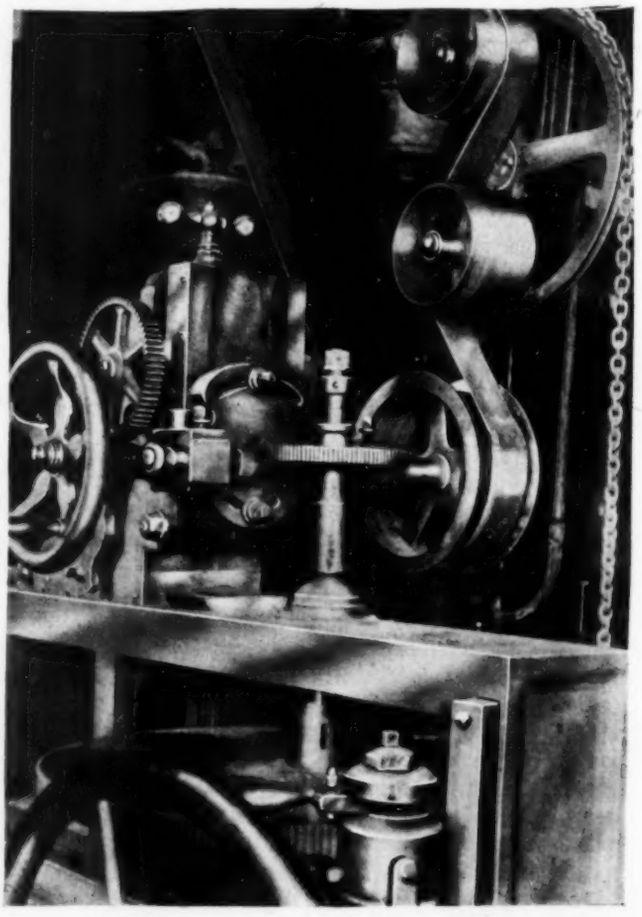
At the present time plants are reporting to headquarters by means of charts, and headquarters, in turn, are using the same means of reporting to the government.

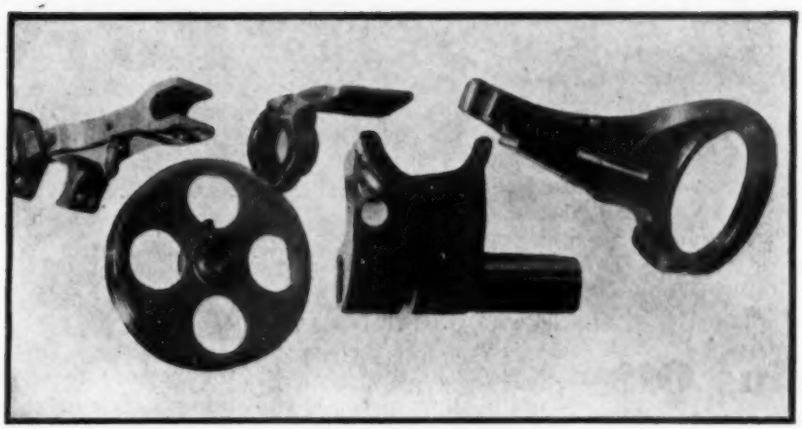
Such are, in brief, the tremendous possibilities of properly utilizing the means of production now rapidly being installed throughout the Soviet Union.

Will these possibilities be realized, or will the theoretical knowledge remain an abstraction crushed under the passive attitude of which C. Mejlauk spoke? Whatever the answer will be, we on this side of the Atlantic cannot neglect the challenge.

A Gear Cutter of 45 Years Ago

BUILT by the Putnam Machine Company and sold to the Consolidated Fruit Jar Company, New Brunswick, N. J., in 1886 or 1887, this old gear cutter now forms a part of the equipment of a small machine shop in New Brunswick, which purchased it in 1917. The machine will cut a gear with as many as 1788 teeth. The photograph was sent in by Charles C. Tomney, chief tool designer of the Brunswick-Kroeschall Company, whose father owns the machine. There is no power feeds.





Complex zinc base die castings may be successfully nickel-plated if certain precautions are observed

Nickel Plating Die Castings

J. T. GILMORE
Plating Department, Dictaphone Corporation

SUCCESSFUL plating of zinc-base die castings with nickel, in such a way that the plate will not peel, has proved something of a problem in many shops. The difficulties involved have been overcome in the plating department of the Dictaphone Corporation by following the procedure outlined below.

When received, castings are first rough-ground, using No. 150 emery, and then are finish-ground with No. 200 emery, after which they are buffed and polished with tripoli, and finally are colored with white lime. A cleaning with benzine follows to remove any trace of the buffing and polishing compounds. Great care is exercised to see that no pourous castings are used, as pores tend to retain some of the plating solutions which later cause pitting or peeling of the plate.

In the plating room, the first operation is to dip the castings for one-half minute in a non-caustic cleaner. Metso is one of the commercial cleaners that has been used with success, the concentration being four ounces per gallon of water. Castings next are rinsed in cold water and then are pickled for about one-half minute in a solution consisting of one part commercial muriatic acid to twenty parts of water. This completes the cleaning operations, and the parts are ready for plating.

Naturally the plating solution is most important. It is made up by dissolving 12 oz. of sodium sulphate, 12 oz. of single-nickel (nickel sulphate), 1 oz. of boric acid, and 2 oz. of sal ammoniac in one gallon of water. This solution is not used in production work until used first on scrap parts for three days. Thereafter it lasts almost indefinitely and does not become contaminated with zinc. Sludge is cleaned out perhaps once in six months, and any loss is made up by adding new solution. Anodes that contain from 95 to 97 per cent pure nickel are employed.

During the first minute of plating, a four-volt potential is applied to make sure that the nickel is "thrown" onto parts of the rather complex castings that otherwise might not be properly plated. At the end of the first minute, the voltage is reduced to three, to avoid blackening or "burning," which would result if the higher voltage were maintained. At the end of five minutes, the three-volt potential plating is completed, and parts are removed and rinsed in hot water. A majority of the parts plated are strung on copper wire or are hung on racks made especially to fit them. In the case of the mandrel on which the Dictaphone cylinder, used for recording speech is placed, the shaft, which does not require plating, is shielded by slipping it inside a tube which forms a part of the rack.

In the plating of steel parts, much the same procedure is followed, except that a flash of copper is given them before nickel plating. On zinc-base die castings, however, a flash of copper has proved detrimental, since it tends to produce blistering.

Peeling of the plate from die castings is likely to result if they are left too long in either the cleaner or the pickle, as in either case a coat of oxide is formed. For this reason, the time named for these operations should not be exceeded. In fact all operations should be timed carefully to assure consistent and satisfactory results.

■

Nitrided steel has found a new application at the Newton Die Casting Corporation. The aluminum-base alloy center post for the "1900 washer" is die cast around a long core at a temperature of 1,400 deg. F. With former practice, pits and checks appeared in the core making its removal troublesome. 25,000 to 50,000 castings were the limit from one core. Nitrided steel cores now give 100,000 castings per core and, because their non-scoring surface permits easier removal, faster production. Incidentally, bronze "oilless" bearings are cast as inserts in these center posts.

The Foreman's Round Table

Signing Off

At Home.

DEAR ED:

The weather has been hotter than all-get-out here, and I wish that either you were here suffering with the rest of us or that I was where you are, but not fishing. You will be glad to hear that Williams has taken advantage of your absence to issue another order, or rather series of orders. I tell you this to increase your enjoyment of your vacation and whet your anticipation of returning to this—well, I'd get arrested if I wrote what this town is like just now. You were a lucky guy to go when you did.

The notice Williams sent out reads as follows: Subject, Signing Forms.

"The signing of requisitions and time allowances, especially when done in quantities, is very apt to degenerate into a routine matter. To obviate this, I suggest the following method, which will be in effect from this date:

"All authorities for the purchase of material will be signed in ink with full name; the idea being that this should be done at the desk, with due time for consideration.

"For approving time allowances, colored pencil should be used. O.K., and the signer's initials being sufficient; the idea here being that the absence of the distinctive color would be evidence that the allowance had been signed without thought.

"On storeroom requisitions, name should be written out in full with lead pencil. The storeroom will accept no requisitions with initials.

"Quit slips, where a man is discharged, should be signed in ink, as this also is a matter which requires consideration. Initialing quit slips other than those for men discharged, is sufficient.

"On application blanks, a ring around the rate, and initialing is sufficient.

"The above applies only to the approval. In any case where the one approving has written the body of the blank, it is not necessary for him to use the methods above outlined, ordinary lead pencil being sufficient." Signed, G. B. Williams, Gen. Supt.

I know this notice will meet with your approval, at least to the same extent that other notices have, and that you will receive it with your usual hearty, if profane enthusiasm. You will have to watch your step on this order. It has already got one objector into trouble. Your friend "Charley the Buyer," said that he didn't care how purchase requisitions were signed, he would check them anyway. He also objected to the first paragraph saying that signing was apt to become a routine matter. Williams lost the argument, but he wrote out a pre-dated note for $50, on letter head paper, and put it among Charlie's unsigned mail. Charlie didn't catch it, and yesterday Williams went to Charlie and demanded his interest. I leave the rest to your imagination.

Yours,
Al.

P.S. I like 4-pound sea bass best, you can ship 'em by parcel post if you use "dry ice."

Fishhaven, Mass.

DEAR AL:

I hope you sizzle. It is too darn chilly here. I was glad to hear from you, but if I had known what was in the letter I would have burned it before reading. I might have known something would happen if I left the dump to run itself for a short time. I have no comment to offer on the order except that it is a piece of foolishness, and I don't propose to follow it. There are two times when a man is a damn fool: when he tries to write a love letter to some woman: and when he tries to write an order to restrict the activities of others. I am another for writing this.

Yours,
Ed.

Are the precautions mentioned in the notice necessary in shops where foremen still have authority to make out requisitions? Should the foremen be bothered with routine signing, or should subsequent check be sufficient?

Discussion of Former Topics

Service de Luxe

Williams' plan to keep the tool cribs open ten minutes after the closing whistle will accommodate about 10 per cent of his men, the other 90 per cent will continue to turn in the tools that have to be returned to the crib, before the whistle blows. The piece worker is more interested in getting prompt tool-crib service during working hours when he is in changing jobs.

I have been in shops where I have seen a worker stand in line at the tool crib ten minutes waiting for a change of tools.

If tool cribs are open in the morning, before the whistle blows, the piece workers will take advantage of the opportunity, for then they are anxious to get their jobs started, but at night they are usually tired and anxious to quit and go home, so all tools will be turned in and time cards taken care of before the whistle blows.

—L. G. PATTERSON,
Factory Superintendent, Armstrong Machine Works.

Slowing Down

If men were now producing at the same rate as they produced two years ago, the number of unemployed in the metalworking industry would be much higher than it is, for we know that employment has not been curtailed nearly as much as has production during the same period. Neither have men slowed down in proportion to the volume of work, because if they had there would be no such thing as unemployment in the metalworking industries.

Some day manufacturers may be able to guarantee their workmen a minimum of five days work at the average rate, and if a man can do his quota in four days he will be entitled to use the fifth day as he wishes, provided there is no work ahead.

Until this is done men will slow down when work is scarce. It is hard to impress upon the mind of a man with a family to feed and clothe that when he slows down the company loses money, which will force it to cut wages and reduce the working force. The present is the most important time for any man when his resources are exhausted. When a man can get through each day without too much hardship he somehow has confidence in the future. You can't make a man enjoy starvation by promising him a banquet three months hence if he is still surviving at that time.

—CARL A. E. JOHNSON.

Slowing Down

A general slowing down in the output of a concern may sometimes be laid directly at the feet of the immediate superiors of the men, and again it may be due to complex psychological reasons hard to define. Through some infinitesimal act of one of the men, or of a leader, this general slump will start in one department and flow, in some unknown manner, throughout the whole shop. The condition usually defies any and all methods of "putting the finger on it," and gradually runs out by itself.

This mysterious diffusion throughout the plant may be likened to the "grape-vine telegraph." One knows that something is going on but cannot define or detect the means by which the matter in question makes its circuit. On the detection of such a depression beginning in one of the departments, immediate and forceful steps should be taken to quash it then and there.

Foremen should be chosen more for their ability to handle difficult situations and for loyalty to the firm than for extensive technical knowledge. This does not mean that a man who does not know what the department is about should be subject for consideration, but that a reasonable balance should be effected for maximum results. Another thing that may help would be to give younger men, men with considerable vitality, preference in choosing a leader. If the older man is more valuable because of his training, knowledge and loyalty to the firm, a younger man should be given him to act as his assistant and leave the foreman more time to devote to abstract problems which may arise.

—PHILIP DEL VEECHIO.

Taking a Gamble

The possibilities in answering a blind ad look very slim for the applicant.

To begin with, it is unlikely that an employee will get an advanced job by answering a blind ad which has been inserted by his present employer. The ad would never have been run if the employer considered any of the employees capable of holding the position.

Furthermore, it is very doubtful if the man could land the job if he had not attracted favorable attention to himself in the shop. However, he should not lose his job, as answering was not an indication of being dissatisfied, but rather an indication of a desire for advancement.

—C. F. STAPLES.

The Deadline

First, last and always the logical deadline for vacations should be the one outlined to an employee when he is hired. Any deviation from this ruling that does not favor the employee is unfair to him and brings the management adverse and widespread criticism.

Should a new ruling in this matter favor the employee it will brighten his outlook, at least momentarily and materially improve his work.

I have known cases where vacations are handed out freely and without restraint, where some men will take all they can get. They will not show up on Saturday if their vacations are scheduled to start the following Monday, and will not be seen at the office until a day or so after they are due.

Sometimes, if there happens

to be a general holiday within their prescribed vacation they will take another day off for this reason.

In these cases there is no doubt that a real vacation is enjoyed, and I do not believe any executive would call a man to account for one infraction, but it seems to me that a succession of these and similar incidents from an employee would tarnish his record a bit.

—RALPH M. GAMBLE, *Jones & Lamson Machine Company.*

Gilding the Lily

A man who possesses tools reading to 0.001 in. can work to 0.001 in. A man who does not possess such tools cannot be sure of his measurements within less than a tolerance of 0.003 in. at the best in the case of comparisons, and ±0.005 in. in the case of direct readings from a scale. For roughing out, scales and calipers are accurate enough, but a man who is not able, or prepared, to work to close limits must keep on roughing out until he is. I have never come across a man who has been hampered by the possession of too many good tools, but I have met plenty who have been worth less because of the lack of them. I have seen apprentices wasting time with newly purchased tools and working to closer limits than those specified, but the novelty soon wore off and one does not begrudge them the experience gained, knowing that it will be used later on.

When calipers and scales are being used men think in terms of 64ths and when using micrometers they think in terms of thousandths. The dials on machine tools are graduated in thousandths, so whatever time is lost in measuring with a micrometer is made up for by simplification of calculations and by cutting out guess and try methods.

—H. JAMES, *Birmingham, England.*

Who Pays the Bill?

A tool crib man has to possess a combination of qualities more or less common to positions of trust in which valuables are handed. No system of handling such valuable tools as are found in modern machine shops can be infallible, and none will be successful unless the rules are followed.

A parallel can be found in handling money; no cashier or teller could ever hope to keep his account, or his job, if he did not carefully make every entry as required by the rules laid down for him. In my opinion, the kind of system does not really matter if the crib keeper is conscientious. But the tendency is usually toward finding a job for some poor old codger who is past his usefulness for other work, on the theory that all he had to do is to pass out tools and accept checks in return. Of course, it is entirely possible that an old machinist can be found who would fill the specifications, but such men are usually prone to argue with the workers, about the proper tools to be used, etc.

Usually a younger man with little or no mechanical experience, but a sense of responsibility and common sense, will make a better man if well grounded in the system.

—JOHN S. ISDALE, *International Silver Company.*

Direct Action

It has been a long time coming, but there does now appear to be a movement towards recognition that the general advance in the efficiency of industrial production has been due and is still in the hands of the shop and technical management.

The figuring and clerical departments can be looked upon as essential departments, but only inasmuch as they keep a record of essential figures and facts and carry out certain routine operations. They are, decidedly, service departments, although their heads are often called upon to act as advisors to the boards of directors. The fact that the type of work performed differs from the production side to the extent that it is not concerned with the problems of engineering has led to the establishment of separate major departments with consequent over-emphasis of the importance of their functions to the detriment of the production division. The natural result has been that far too many companies are guided by a group of men with the accountancy outlook, and the game of business has been treated like a game of chess. The engineer is only too well aware of the limitations and the consequent necessary treatment of men, materials and machines. Not only should Williams be placed on an equality with the heads of other divisions, but his division, that of manufacturing, should be regarded as the senior division. He is, in effect, director in charge of manufacturing and is likely to become vice-president in charge thereof.

—S. A. KNIGHT, *Kirkuk, Irak.*

Share and Share Alike

The idea of paying a dividend to the worker in the same way as one pays a dividend to a stockholder sounds feasible until one thinks of the time when the firm is experiencing a depression and there is, instead of a dividend to pay out, a reduction in the value of the stock.

In the case of a man who puts in his labor, he does so with the idea of obtaining an immediate return for the commodity which he sells. Whereas in the case of the stockholder, he is expecting to share in any increased value of something which he buys. He has also to be prepared to share in any loss in value of that article.

The two cases do not run parallel, and since the fundamental differences are those of buying and selling, it is difficult to see how they can be made to parallel each other.

Viewing the suggestion from a different angle, it must always be a matter of regret to a small stockholder with a keen business sense, that he cannot exercise any controlling influence in the business in which he has placed his capital. He is bound to sit as calmly as possible while someone else's efforts determine the amount of profit or loss which will accrue to him.

This outlook is also shared by the best type of workmen, who resent the fact that their remuneration can be governed by individuals of lesser ability than themselves.

This is evident in the working of all gang- and collective-bonus schemes, and is the primary reason why the individual bonus systems are generally preferred by the best workmen.

Taking the matter broadly, incentive systems are of little use unless the objective is so set that it contrives to increase the remuneration of the individual in accordance with the efforts put out by the individual and the increase in his production.

—A. WILLIAMS, *Chief Estimator, Bristol Motor Works, Bristol, England.*

Machining Duralumin

JOHN YOUNGER
Professor Industrial Engineering
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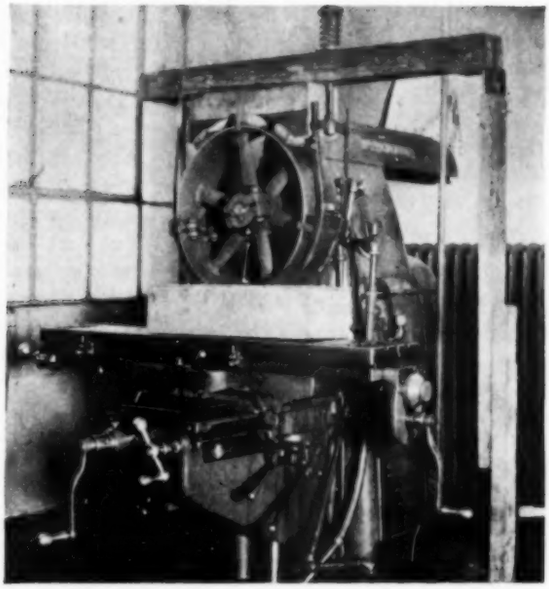

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Results of laboratory tests with different sizes and shapes of cutters

IN RECENT years aluminum alloys have been developed to supply engineering materials having mechanical properties comparable with those of mild steel and at the same time retaining the characteristics of the parent metal. Briefly summarized, these include low specific gravity, good resistance to corrosion, high thermal and electrical conductivity and a pleasing appearance.

By a combination of processes it is possible to produce a material having about three times the strength of commercially pure aluminum and with strengths comparable to those of mild steel combined with sufficient workability to permit considerable forming. The metal considered in this article was of this nature, having a tensile strength in pounds per square inch ranging from 55,000 to 63,000, and a Brinell hardness (500 kg. load, 10 m.m. ball) from 90 to 105. The use of such material in place of steel makes possible a saving of about three-fifths the weight without loss in the ultimate strength of the structure.

A series of tests were made in regard to power consumption in machining both cast and wrought Duralumin by the Aluminum Company of America. These tests were made under the auspices of the Ohio State University Engineering Experiment Station and the Department of Industrial Engineering. In carrying out this work a Cincinnati No. 2 M Plain Miller was obtained and cutters were supplied by the Goddard and Goddard Company of Detroit.

The first step in starting the work was to determine the efficiency of both machine and motor. In making the machine efficiency tests, loads were applied to the machine through the use of a prony brake lubricated by running water. Readings were taken for each spindle speed of the machine and from the brake horsepower formula,

$$HP = \frac{2\pi NrWL}{33{,}000}$$

L = length of brake arm in ft.
N = r.p.m.
W = weight on scales.

The output was obtained in horsepower.

By having a watt meter on the input side of the machine it was possible to obtain the input in kilowatts as well as the output from the previously mentioned formula. Having obtained this information, the motor was removed and its own efficiency determined so it would be possible to tell just what percentage of the input was being delivered by the motor. It was found that the motor ran approximately 80 per cent efficient or, in other words, it was possible to obtain 80 per cent of the input for use in the machine.

Having completed both tests the results were plotted in graphic form for each spindle speed, having as the ordinate the output in hp. at the spindle and the input in kw. as the abscissa, giving the overall efficiency curve of the machine for each spindle speed.

The preliminary work being completed, everything was ready for the cutting of the test specimens. In making cuts the same type of cutters were used for all the work, namely, a 6-in. x 4-in., 8-tooth, slab mill with a 45-deg. spiral angle, a 6-in. smooth-back, side mill with 24 teeth, and a 15-deg. spiral angle, two 6-in. side mills, one 1 in.

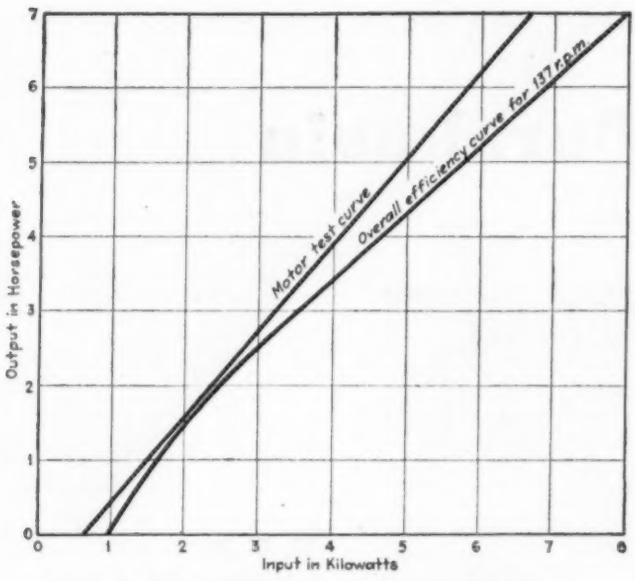

Fig. 1—Motor test curve giving the over-all efficiency of motor and the over-all efficiency of motor and machine at 137 r.p.m.

and the other $\frac{1}{2}$ in. wide, and an $8\frac{1}{2}$-in. inserted-tooth face mill. All cutters had a 9-deg. rake angle and in carrying through the work the cutting edges were kept as near the average edge as possible.

The feeds used were $1\frac{3}{8}$, $1\frac{7}{8}$, $2\frac{5}{8}$, $3\frac{1}{8}$, $5\frac{1}{2}$, $7\frac{3}{8}$, $10\frac{3}{4}$, 15 and 20 in. per min. The spindle speeds were 82, 102, 137, 183, 234, and 316 r.p.m., or a peripheral speed of 86 to 330 ft. per min. on a cutter 4 in. in diameter, 128 to 500 ft. per min. on a cutter 6 in. in diameter, and from 183 to 700 ft. per min. on a cutter $8\frac{1}{2}$ in. in diameter.

On many of the cuts where a high peripheral speed was used the overload on the machine became so great that it was necessary to discontinue cuts of great depth and width. It so happened that a 7-hp. motor was being used on a machine that was built for a 5-hp. motor.

Each cutter gave excellent results except the 24-tooth, smooth-back, side mill. When running at high speeds, and also at high feeds, there was a continual clogging of chips between the teeth. In some cases the metal packed so hard that it was necessary to remove it with a chisel and hammer. Just as soon as this clogging would begin there would be a continual increase in the amount of power consumed, because of the increase of friction, giving false readings, unless the metal was removed frequently. Upon receiving the 24-tooth, smooth-back, side mill it was suggested that $\frac{1}{16}$ in. be ground off every alternate tooth if the metal packed between the teeth. This suggestion was carried out, but upon resuming cutting it was found that the small clearance offered by the dead tooth was insufficient to give the proper chip clearance, especially at the higher speeds and feeds where the chips became heavier. So it was decided that it would be necessary to grind every other tooth completely out, making a coarse-tooth mill having only 12 teeth. By this means the chips were given ample clearance and packing was prevented between the teeth.

In using this type of cutter results were rather poor in regard to finish, and for running performance at the lower speeds, making it necessary in many cases to run the cutter at relatively high speeds in order to get the finish that may be obtained in the proper machining of aluminum. But this should be no serious handicap because the workability of the metal permits the use of the higher speeds with no serious results to the cutter.

In some cases it was necessary that high speeds be used in order to get readings from the input meter. It was found that with low speeds and comparatively light cuts the power consumed was so small that it was almost impossible to get accurate readings for tabulation. This was a peculiar condition met with only when using this type of cutter. When using a cutter with 24 teeth the power consumption was higher for the same speeds and feeds and it was possible to obtain accurate readings for tabulation on the data sheet.

With this situation in hand, a new field was opened up for experimentation and that was to find out just

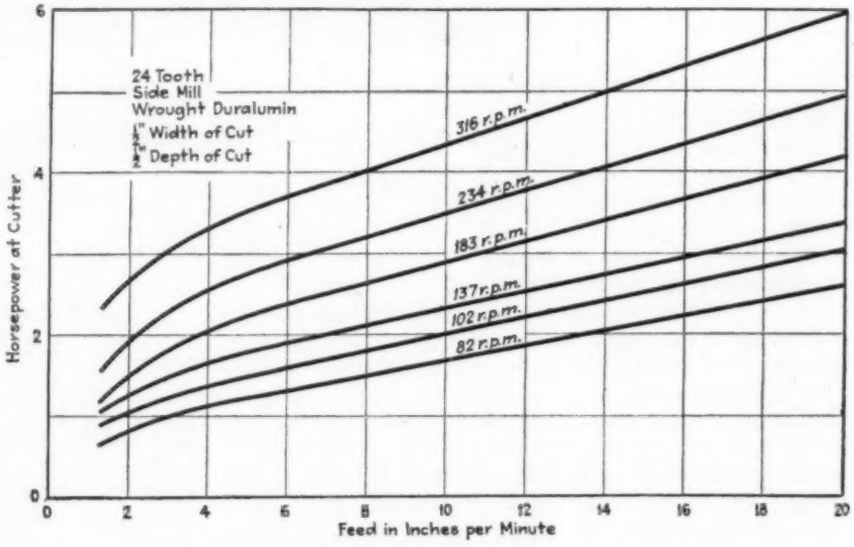

Fig. 2—Horsepower consumed by 24-tooth side mill at different rates of feed and speed

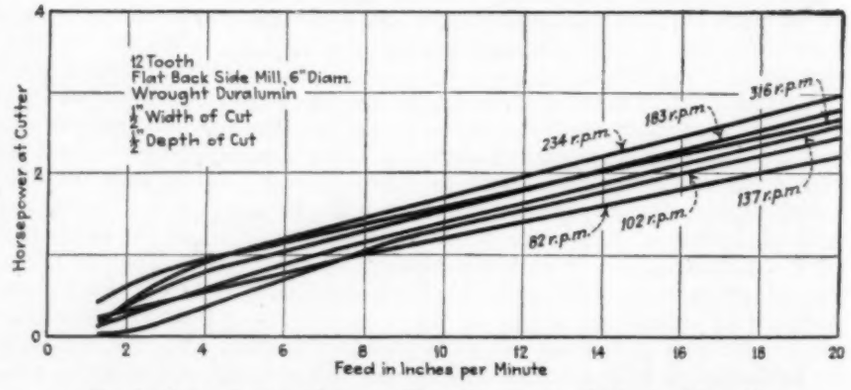

Fig. 3—Same chart as shown at Fig. 2 for a 12-in. flat-back, side mill

how much power was being saved by using the 12-tooth over the 24-tooth cutter.

In carrying out this phase of the work, a complete series of cuts were made with the 12-tooth mill, then the same series of cuts were run with the 24-tooth mill. In order that a check might be had on the first set of cuts, a second set was run on each cutter and then the results of the two tests were plotted. Upon completion of the plotting it was found that the average amount of power saved by using the 12-tooth mill was approximately 35 per cent; that is, where the 12-tooth mill required one horsepower at the cutter to make a $\frac{1}{2}$-in. depth of cut and $\frac{1}{2}$-in. width of cut, the 24-tooth mill took 1.5 hp. to make the same depth and width of cut. This, at first thought, does not seem to be a very great saving, but upon the continual use which is required of a machine in production work this small amount of horsepower saving will mount up when it comes to figuring up the consumption rate over a period of time Power consumption per unit metal removed is always a function of chip thickness. This checks with De Leeuw's work on coarse pitch cutters.

While these tests were being run, other difficulties were encountered. At certain speeds vibrations were set up in the machine. These vibrations as a rule were greater in the lower speed ranges. In many cases it was necessary to discontinue cuts because of the action these vibrations had upon the cutting performance of the mill, quite often giving a herringbone effect to the finished surface. The action resulting from these vibrations in general had an effect on the power consumption similar to that produced by the clogging of the 24-tooth mill. Just as soon as any disturbance was set up an increase in the amount of power consumed resulted. Never was this so great as in the case of the 24-tooth mill but it was great enough to give a distorted reading. This problem of machine rigidity proved itself to be a vital one, especially when it is desired to obtain a highly finished surface.

In machining aluminum and its alloys, kerosene has proved valuable as a coolant and in the work undertaken in this project this form of coolant was used. There are also several other coolants which may be used and which give satisfactory results.

In carrying out the work there were some rather interesting conditions observed in regard to the use of kerosene. It was found that in order to obtain a highly machined finish there must be an ample supply of the liquid to keep the cutter at its most efficient temperature. This statement might seem quite obvious, but when working, one is apt to cut the flow too close, causing the cutter to heat up. As the temperature increases it reaches the vaporization point of the kerosene and a thick white vapor appears. This vapor may not be harmful in any way, but it is not a good heat conductor. In several of the tests the cutter was run hot to observe the effect on the power consumption. As soon as vaporization started there was a marked increase in the power consumption, this being attributed to the increase of frictional resistance that took place upon the heating up of the cutter.

After having completed the necessary tests with the various types of cutters and the recording of data, it was necessary to put the results in the simplest form. From the efficiency diagrams that were previously described it was possible to determine the output at the spindle for a definite kw. input. Suppose that a feed of fifteen inches per minute was being used and a spindle speed of 137 r.p.m., and the input for this particular cut was 7 kw., then, by referring to the efficiency chart for this particular speed, it is easy to determine the horsepower output obtained at the spindle by tracing the ordinate at 7 kw. to the curve and then across to the horsepower division which gives, in this case, an output of approximately 6 hp. Now taking the Cutter Performance Chart which has as the abscissae feed in inches per minute, and the ordinate horsepower at the cutter it is possible to locate points for a curve for this particular spindle speed and for the various feeds and depths of cuts used. Having located points for all the feeds used and connecting these points with a smooth line, a curve is obtained which will give the amount of power required to make a certain depth and width of cut at the cutter. This is important from the standpoint that it enables one to determine the input that is going to be required to make a certain type of cut. After having obtained this input, it is easy to convert it to horsepower and determine the size of a machine needed for a given type of work.

Charts of this type were made for all the cutters used on both the wrought and the cast metal, giving a complete set of performance curves for all speeds and feeds available on the machine.

Electric Resistance Brazing—*Discussion*

A. Eyles

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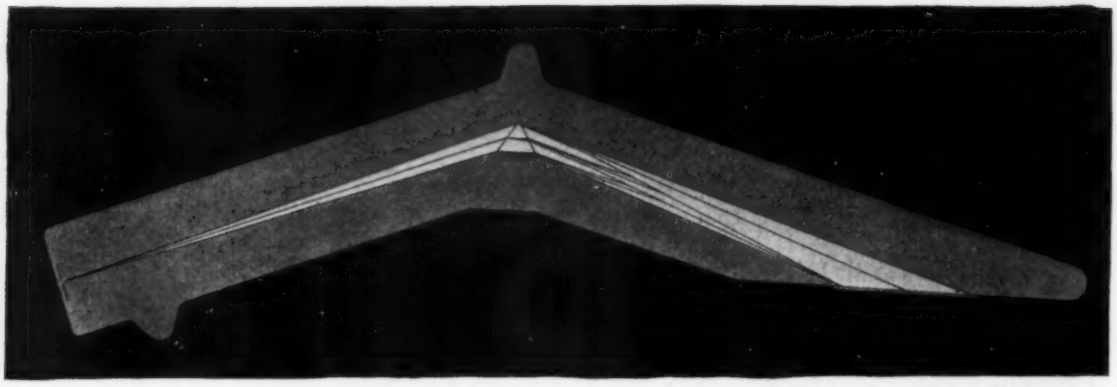
HAVING had considerable experience in the technique of brazing metals by various methods, I should like to add a few words to the discussion by W. C. Reed on page 779, Vol. 73 of *American Machinist*.

Experience teaches us that there are certain difficulties met with, particularly in regard to brazing pieces of metal together differing largely in bulk, because of the difference in the time required for heating them. Fortunately, most difficulties can be overcome by employing suitable jigs and regulating the current and speed of heating. Time is another important factor where the component parts are very dissimilar in size or mass.

The question of the contact area of the jigs is important, particularly on large articles where it is essential that overheating shall not take place. It is generally advisable to have as large a portion of the article as possible in contact with the jig, as by so doing the speed of heating may be increased because of the amount of current that can be sent through a larger cross-sectional area. It is essential that jigs be kept perfectly clean. Hence, they should be washed over frequently with a brush and clean hot water. The brazing flux acts as an insulator to the low voltage current and would, if allowed to accumulate, entirely prevent the work heating to brazing temperature. This remark refers principally to the smaller type of articles where it is difficult to keep the flux from getting on the jigs.

One striking example of modern application of brazing is in the manufacture of gold or gold-filled spectacle frames and jewelry work. One operator working one electric brazing machine with an assistant filling the jigs achieves 900 joints per hour, putting the bridge pieces on the frames of spectacles.



When light rays pass through a prism, short waves are bent more than long ones

Optics in Metal Working

II—The Spectroscope

KEN G. NIBLACK
Bausch & Lomb Optical Company

The spectrograph is neither cumbersome nor complicated

AN UNKNOWN material—an electric spark—a rainbow of color—and from it a knowledge of that unknown material. Like Aladdin's lamp, the spectrograph now gives metallurgists a knowledge of the composition of strange metals, it tells what is in them, what elements are mixed in the alloy and approximately how much of each. Every week, in fact every day, new materials are being analyzed by this method and it is only a matter of time before minerals, liquids, solids or gases will be quickly and accurately analyzed, both quantitatively and qualitatively by the spectographic method.

Spectral analysis is not new; astronomers have been using this method since the middle of the last century to determine the materials in the sun and stars. Sir Henry Roscoe used a spectroscope in controlling the blow in Bessemer Converters more than fifty years ago, and de Gramont was successful in analyzing enemy munitions during the world war. But for some unknown reason, perhaps a lack of leadership, the advantages of the spectrographic method have not been widely appreciated until the past few years.

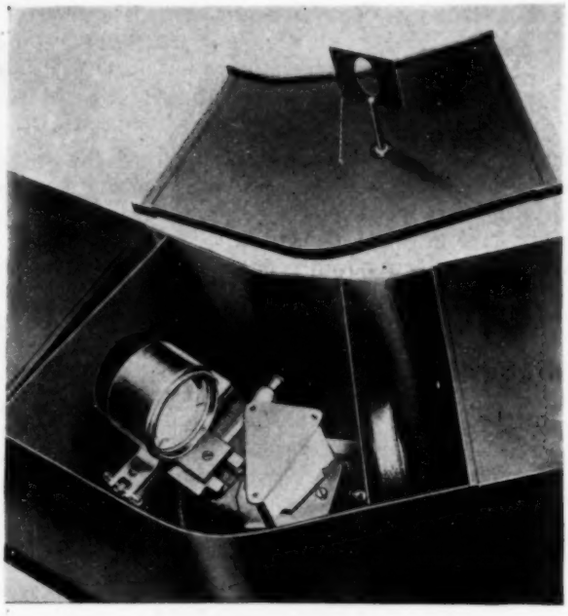
In industry, today, by using an electric spark or an electric arc, we are able to volatilize materials about which we would like to have information and the incandescent vapor of the material will often give more accurate information than a chemical analysis.

There are many different types of instruments manufactured for use in spectral work, but the one having the most universal application to industry is necessarily a recording instrument for work extending into the ultraviolet. The instrument illustrated is the Bausch and Lomb Quartz Spectrograph, an all-metal instrument with quartz optics. The material to be volatilized is placed on one electrode of an electric arc or spark and the light from the incandescent gas of the material passes through the slit into the instrument, is split up into its components by the analyzing prism, and the resulting spectrum is focused on the photographic plate.

To the layman, very little is in evidence from the appearance of the spectra shown in the illustration. Yet each of the lines has a significance according to its position on the scale which is seen below the spectrum. From these lines the experienced spectrographer can tell exactly what elements are in the material being analyzed, and this method is so sensitive that he can find the smallest traces of most elements as easily as larger amounts. One of the biggest factors in the use of this method is the speed with which analyses can be made. An analysis which would require hours and even days by other methods can be completed in minutes with the quartz spectrograph.

There can be no error in qualitative examinations. One element is practically never mistaken for another as is the danger with chemical methods. Identification is positive.

In addition to its sensitiveness, speed, and certainty, the spectral method is complete; it contains the spectrum lines of all metallic and many non-metallic constituents. The chemical analysis, on the other hand, gives only those specifically looked for. Even then, it often fails to reveal



The quartz prism at the center of the apparatus

the important facts when abnormal conditions are present or unfamiliar materials are involved.

When to these considerations is added the fact that any element that can be detected qualitatively, can also be determined quantitatively by spectrographic methods, the wide field of usefulness is doubly apparent.

Many manufacturers have found in spectrographic methods the means to an accurate interpretation of their materials. In the following paragraphs Mr. Charles C. Nitchie describes how the quartz spectrograph is being used.

"Die-casting alloys sometimes suffer serious deterioration if even slightly contaminated by residual metal of other kinds left in the melting pots from previous melts or by the use of impure raw materials. The quartz spectograph surely and quickly reveals such contamination and avoids the production of defective castings.

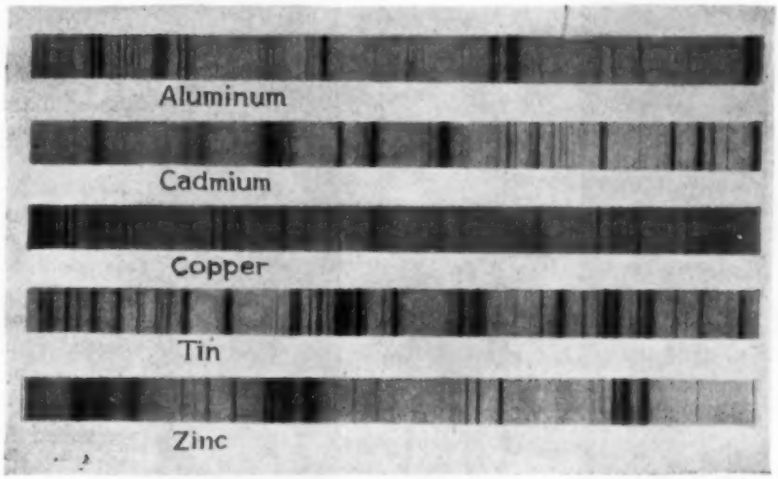
"A commercial zinc alloy used for corrugated sheets for roofing and other structural purposes contains a minute fraction of one per cent of magnesium. It must be kept within rather close limits to produce the optimum result. This constituent is oxidized and lost if the alloy is held too long or at too high a temperature in the molten condition. The control of its manufacture is based on spectral analysis which insures that the proper amount of magnesium is always present.

"The inspection of materials bought on specifications which limit the amount of impurities is carried out simply, quickly and accurately with the quartz spectrograph. White lead, pig lead, babbitt metal and other alloys are inspected in this way.

"The quick classification and sorting of scrap metals is greatly aided by spectral methods. Alloy steel scrap brings much higher prices than ordinary steel, provided the purchaser can be assumed that a given lot contains only one kind of metal. This is guaranteed by analyzing each bar with the spectroscope.

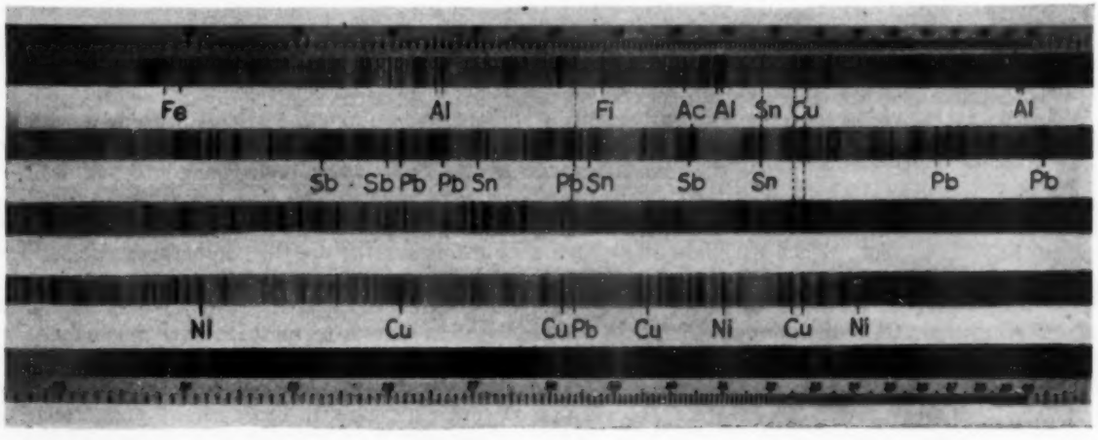
"Metal stocks in works or warehouses sometimes become mixed. Confusion, delay and faulty products are easily avoided by the use of the spectroscope or spectrograph for sorting mixed metal."

The second of a series on optical instruments for use in metal working.

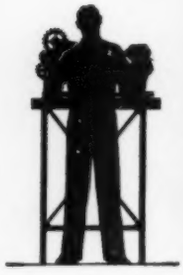


Since short waves are bent more than long ones, the images of the different wave lengths are sorted out and dispersed, each in definite relation to its length. The positions of the vertical lines on a scale reveal what elements are present

Typical records, with the wave length scale at top and bottom



Many inventors dream of fortunes to be gained through the sale of their patents



The majority face disappointment through ignorance of what determines a patent's value

What Is Your Patent Worth?

JOHN P. NIKONOW

Patent Attorney
Mechanical and Electrical Engineer

THE aggregate value of patents in the United States probably extends well into billions of dollars. And while the average value of each patent may be rather high, the actual value of a large number is nominal or nil. Every inventor thinks that his patent, if granted, will have an attractive value. Many of them are disappointed, but practically all are confronted with the problem of determining, at least approximately, the actual or selling value of their patents.

The majority of inventors confuse the value of an invention with the value of a patent, which may be quite different. A very valuable invention may be covered by weak patents. For instance, if the broad or basic patents have already expired, the existing patents may cover only certain details or parts of the complete device.

Usually it is difficult to determine the scope of patent protection until the patent is granted. Then it may be easily ascertained from an examination of the patent claims. The first step, therefore, in appraising a patent consists in a study of its claims. Two principal questions must be answered:

1. Does the patent cover a complete device, or process, or only certain details?
2. Does the patent cover the invention so broadly as to include all the possible practical modifications.

The first question can be easily answered by glancing over the claims. The drawings and the specification may describe a complete device, but the claims may be all limited to one detail. In such a case the value of a patent is determined by the value of this particular feature, to the extent it is needed, and whether it can be sold independently of the main device. The second question is more difficult to answer. The claims must be scrutinized for possible loopholes which may permit others to get around the patent. The invention must be reconstructed in various other forms to ascertain whether these new forms are also covered by the claims.

To be broad, the claims must contain very general expressions. For instance, if a chain of gears is employed to transmit the motion, then it must be specified as a "means to transmit the motion" which will include every other method, such as chain or belt drive. If gears are mentioned in the claims, the patent may not cover a modified device with a chain drive.

Having determined the scope of patent protection, the next step is to make an infringement search. This search is conducted in the Patent Office files and must include all the pertinent patents for the last seventeen years. This search may not be necessary if the patent contains broad claims which exclude the possibility of an anticipating patent.

With narrow claims or limited protection, there is always a danger that there are some patents with broader claims which anticipate the particular invention, so that the complete device cannot be built without permission from the owner of the broad patent. The latter in turn cannot use the particular improvement covered by the limited patent. The inventor and the purchaser should always bear in mind that a patent does not necessarily give a right to manufacture the complete device as shown on the drawings.

After the extent of patent protection has been determined, the next step is to find out how much the patent is worth. This problem is especially important to an inventor who wishes to sell his patent outright. If he asks too much, he may discourage the purchasers, and

if too little, he will not do justice to himself. Investigations along this line, may also greatly help the inventor to dispose of his patent on a royalty basis.

There are several phases to be considered in determining the commercial value of an invention. The principal points are as follows:

1. Possible practical applications of the invention.
2. Cost of manufacturing in quantities.
3. Cost of manufacturing equipment.
4. Possible selling price and the profit.
5. Possible users or buyers of the invention.
6. Probable number of articles sold during first, second, and future years.
7. Amount of service required to keep the customers satisfied—possibility of troubles or weak points.
8. Amount of advertising required, introduction by salesmen, demonstrations, and free samples.
9. Advantages of the invention over other similar or competing inventions: economy, reliability, cheapness, or better qualities.
10. How soon the invention will pay for itself when purchased by a manufacturing concern or a public utility. Annual economy or profit from its use.

There may be other considerations in special cases. It should be noted that the relative importance of the above questions may vary considerably for different inventions. Preliminary estimates in answer to the above questions will greatly assist the inventor in getting manufacturers interested in his invention.

A Working Model

In the majority of cases, there is also another vital question asked by the manufacturers: that is, whether the inventor has a working model, and to what extent the latter has been perfected. The manufacturers know only too well how much it costs to develop an invention and work it into a practical device which may be marketed without the necessity of constant changes to eliminate defects which will appear with the use of the device. The invention, as at first conceived, usually contains a large number of weak points which may be eliminated only by building several working models and trying them out under actual service conditions. The whole proposition may be almost irreparably ruined if the device is placed on the market before its weak points have been fully eliminated. It is much more difficult to regain the lost reputation than to build a new one.

Usually questions 1, 5, and 6 must be determined first. It makes a great deal of difference whether it would be possible to sell fifty or fifty thousand devices in a year. A special laboratory instrument, for instance, may be sold only in very limited quantities, so that no manufacturer will be willing to pay a high price for the patent, even if the individual profit on each instrument may be comparatively large. On the other hand, an automobile accessory, if needed, may be quickly sold in large quantities, although the individual profit on such accessories is usually small.

In estimating the possible sales for each year, it should be borne in mind that a large portion of the first year must usually be devoted to the development of the device, designs, models, tests, and then design and building of the manufacturing equipment, special fixtures, tools, and jigs. A certain amount of time must also be allotted to the advertising campaign, tests, and demonstrations. The number of active business years can seldom be taken as lasting through the whole life of the patent. Industry rapidly moves forward in the development of new devices, and the best article of today may be a back number tomorrow. Usually new devices command good sales only during the first three to five years, and are then replaced by other, better, cheaper, more modern, or better advertised articles. This is especially true in such cases—and they are in majority—where the device cannot be covered by a basic patent.

The cost of manufacturing represents an important item. It may mean the difference between the success and failure of the invention. If the cost is sufficiently low to afford a good profit at competing prices, then the patent becomes more valuable and desirable for the manufacturer. The cost estimate is especially important for articles manufactured in large quantities. For instance, a household article may bring greater profits if its manufacturing cost can be reduced to make its sale possible through 5- and 10-cent stores.

It often happens that even with the satisfactory reports on all of the above points, the patent may not find any eager bidders. The following circumstances, for instance, may prevent the sale of a patent:

1. A large amount of money is invested in their present products by manufacturing and operating companies, so that they would not want to make a new and large outlay for new equipment, even if it is better. For instance, it would be difficult to sell a patent for a railroad car coupling, even if it covers a better device than those in use.
2. A particular branch of industry is in a slump. For instance, little use can be made of patents for good devices pertaining to the manufacture and dispensation of alcoholic beverages; to horse-drawn carriages and harness.
3. Climatic conditions or people's habits may sometimes render a patent useless. For instance, a folding bath tub would not be needed in the United States, where all the people who can afford to buy such devices have permanent bath arrangements. But it might be useful in some of the European or Asiatic countries.
4. When the device does not directly bring any profits to its users. For instance, manufacturing or operating companies may be reluctant to spend money on a new safety device unless compelled to do so by the legislature.
5. When the device is so radically new that there is a serious doubt that the people will ever want it, even if a large amount of money is spent on advertising.

All these and similar questions must be considered in estimating the value of a patent. After all, a patent may be profitably sold only if people want the device, and the more they want it, the better price may be obtained.

How Much Will He Pay?

But suppose that the patent successfully passes all the investigations and clearly points to an annual profit to the manufacturer of, say, fifty thousand dollars. How much will he pay for the patent? Will he pay two year's profit? One may rest assured that he will not. There is too much risk involved in buying any kind of a patent, as it may become obsolete or valueless in a short time after its purchase. For instance, a better invention may be made, or different devices come into demand through change in methods or people's requirements. For this reason manufacturers are reluctant to buy patents out-

right and prefer to make a royalty or license agreement.

It happens sometimes that the patent appears so valuable to the manufacturer that he prefers to pay a fair price for it instead of tying himself by a royalty agreement. For instance, Linde's patent for compressing acetylene in steel bottles was bought by the Prest-O-Lite Company for less than forty thousand dollars, yet it proved to be a veritable gold mine during the first years of its exploitation, when all automobiles and trucks used acetylene headlights. Profits ran easily into hundreds of thousands of dollars every year. But it is doubtful whether the company would have bought the patent if the inventor had insisted on a hundred thousand dollars for it, or even seventy-five thousand.

Usually the manufacturer will pay not more than one-half of the possible profits during the second year of the exploitation of the patent. Often a good basis for estimating the price which the manufacturer will be willing to pay for a patent may be found in the estimate of the other expenses which must be borne to place the device on the market. For instance, if the device is expected to bring a profit of about a hundred thousand dollars the second year, and the cost of manufacturing equipment, development, tests, and demonstrations will be fifty thousand dollars, then it is an even bet that the manufacturer will pay up to fifty thousand dollars for the patent rights.

It is much more difficult to obtain a good price for a patent if only one manufacturer is interested in it. It is much better to create buying competition, being sure that all the possible prospects have been approached. Few really valuable patents are sold outright, except when a new company is organized specially for exploiting them, in which case the inventor usually gets stock in this company, sometimes as much as 25 per cent, with or without a cash payment.

A large class of valuable patents cover improvements on existing devices, so it is difficult to determine their independent value. They are usually bought by the manufacturers of the principal devices for modest sums, often but a few thousand dollars. The deal usually involves services of the inventor for further development of his invention. Manufacturers sometimes buy patents, if they can get them for a sufficiently low price—from a few hundred dollars up—if the patents contain some broad claims, although they appear to have no practical value at the present time. This is because it often happens that an apparently useless patent, which was lying idle for several years, suddenly becomes valuable when the devices covered become popular, or when another manufacturer places them on the market, infringing this patent.

Most Patents Bring No Revenue

Statistics show that the majority of patents taken out by individual inventors never bring them any revenue. This is not always caused by poor patents or useless inventions; usually, the inventors simply neglect to bring their inventions to the shape in which they will become interesting to the manufacturers. It is very difficult to sell a patent with patent papers only, without models or certain investigations in regard to practical applications of the device, manufacturing cost, and market requirements. Besides, the market may not be ready for a particular invention at the time when patent is issued.

It is difficult, therefore, and often impossible, to assign to a given patent a certain fixed value. This value may change considerably, depending on a variety of circumstances. Its value may be greatly enhanced, or completely lost, in a few years' time. The inventor must from time to time revise his estimate of the value of his patent, remembering that the patent will be of value only if it is wanted by industry. He must not forget that it is much more important and profitable for the average manufacturer to make a satisfactory agreement with the inventor, than to fight him, running the risk that the inventor will join forces with a competitor in the same field.

The careful and proper appraisal of the market value of his invention and of the value and limitations of the patent, will save the inventor a great many disappointments. It will often prevent his becoming a disappointed pessimist, blaming his failure on the capitalistic world in which the "little fellow" has no chance, and in which manufacturers are interested only in stealing patents or keeping inventors down.

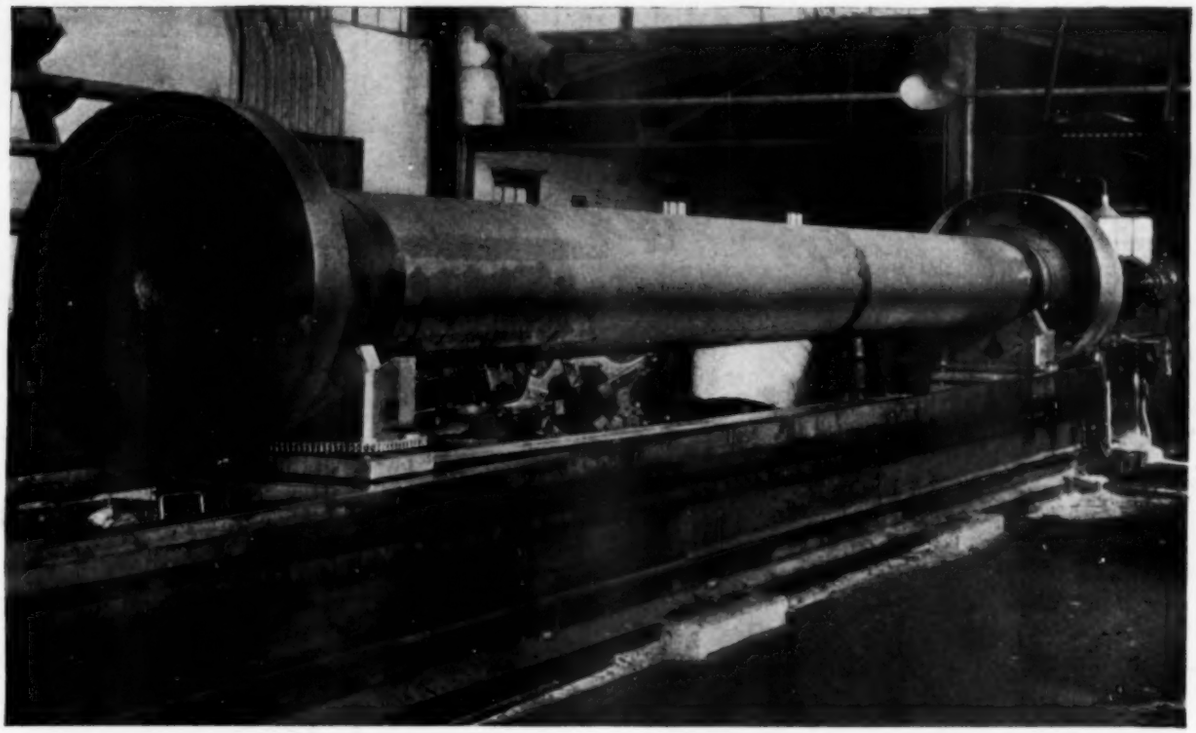
Skill and First Principles—Discussion

B. Brown
East Putney, London, England

TRUE it is that the average shopman does not have adequate knowledge of the first principles of engineering (*AM*—page 213, Vol. 74). The majority of shopmen acquire such knowledge through ordinary routine work, which is of little value when anything out of the ordinary must be undertaken. Technical and night schools could do much to extend appreciation of these basic principles. However, too often it is the executive who is lacking in knowledge rather than the man at the bench. A toolmaker, for instance, may waste a dozen hours trying to get to the bottom of a problem which with greater knowledge he might have solved in as many minutes. The loss to the company is, however, comparatively small, particularly if it is compared with a similar action on the part of an executive, which may cause the company thousands of dollars.

Included in the curriculums of our technical schools might well be more information on such subjects as: the plastic flow of materials, being used in engineering practice ever increasingly in such operations as cupping, drawing, blanking, piercing, drawing, molding and hot pressing; work hardening of metals, including cold-working in particular; the effect of changing the composition of materials; principles of estimating and costing; and principles of plant organization and management.

It must not be forgotten that engineering is a commercial as well as a technical subject. The usual belief is that the engineer, after being technically primed at college, should then undergo a course of commercial training. In actual fact, when he leaves the university he plunges straight into business and exercises what technical knowledge he may have. The commercial side of his training he picks up as he goes along, and many are the blunders he makes until he has acquired a a knowledge of the commercial side. Research engineers and scientists are all very well in their places, but cannot our engineers intending to enter commercial work be properly trained likewise?



The demand for long, hollow shafts has resulted in the development of a reaming device with a 30-ft. capacity

Finishing the Hole in a 30-Foot Shaft

J. P. HARBESON, JR.
Chief Engineer,
Camden Forge Company

DEEP HOLE boring is usually something of a problem in most shops. But the growing use of hollow propeller shafts for power driven ships has forced shops, doing this kind of work, to develop methods for boring shafts with concentric holes, frequently over 30 ft. in length. The usual method is to revolve the work in steady rests and feed the boring bar into the shaft using a fairly heavy pressure of lubricant to wash out the chips and to keep the tool from overheating. Flat drills are used in most cases, it being important to have the cutting edges uniform in both length and angle as this precaution minimizes the tendency to "run" off center. In some cases, particularly where high priced alloy steels are specified, trephining boring tools are used, the core being much more valuable as scrap than regular chip borings.

Neither method of boring leaves the surface of the hole free from tool marks, and as these are always possible sources of incipient cracks, modern practice demands that they be removed. This means either reaming or grinding, or both, which in holes of the diameter and length found in propeller shafts is quite a problem in itself.

The Camden Forge Company, Camden, N. J., has installed special equipment for work of this kind, the machine being a special Hutto grinder as shown. Tool marks are removed by a new tool head made by Hutto and known as a revociper because it both revolves and reciprocates as in the grinding or honing head now so largely used in finishing motor cylinders. This tool head is practically a reamer that resembles the type of milling cutter commonly known as a "porcupine" with the difference that the cutting is done by the curved side of the inserted tooth.

These special heads remove the tool marks of the original boring at a rate consistent with good high-speed steel practice, the circular and reciprocating motions combining to govern the speed. The resultant finish is smooth and accurate. When a mirror finish is required the holes are honed as well as revocipered.

■

Names of things are changing as well as the things themselves. Trepanning used to cover the boring or cutting of holes with a hollow tool or drill. Now trepanning, to those who use it considerably, is confined to work with comparatively shallow holes. Long-, or deep-hole cutting by this method is called *trephining*. Whether we like the new name or not it is good if it prevents misunderstanding. For misunderstandings cause delay and cost money to all concerned.

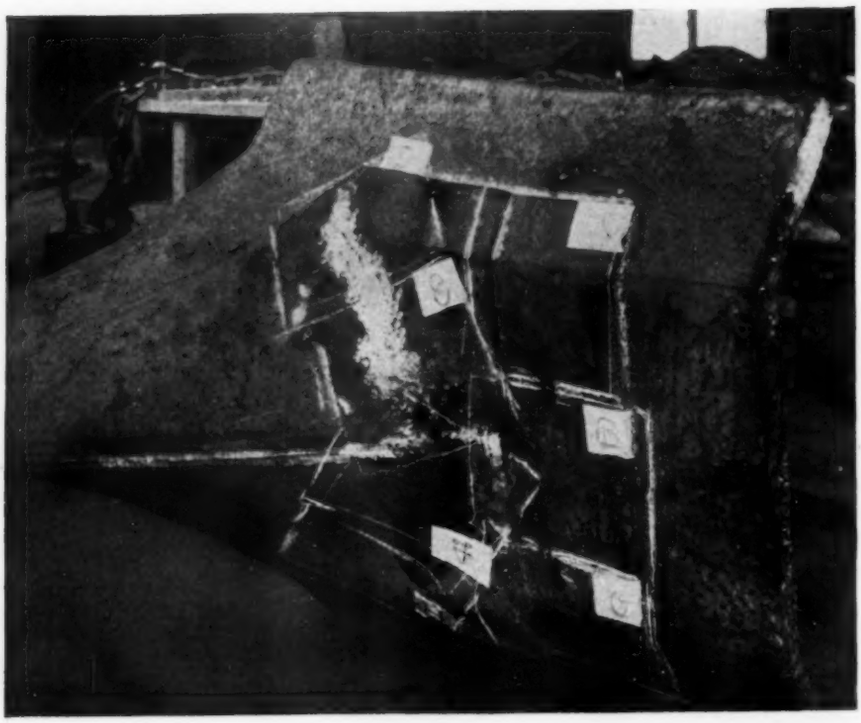


Fig. 1 — Radiographic arrangement upon a large irregular casting

Radiographic Inspection with Gamma Rays

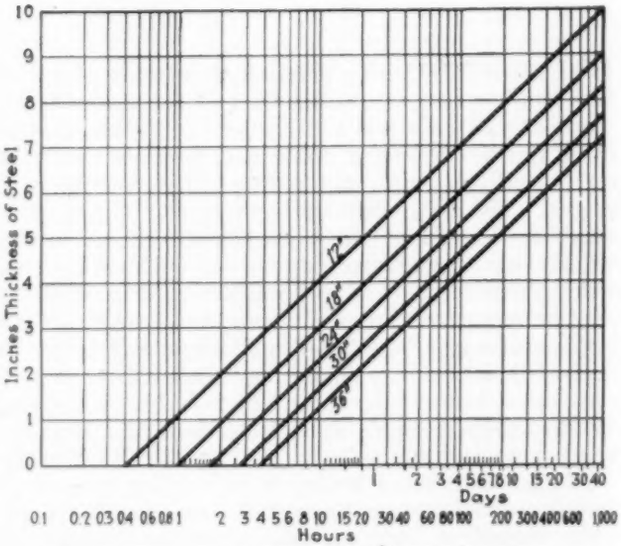
ROBERT F. MEHL, PH. D.
Superintendent of the Division of Metallurgy, Naval Research Laboratory

CHIEF among the problems encountered in the manufacture and use of steel castings and welded structures is that of determining internal integrity. Nondestructive methods of test are coming into increasing use for obvious reasons, radiographic methods in particular because they give a permanent record of the internal defects present in the pieces inspected.

Such methods of inspection are applied in industry in one or both of two ways: each manufactured article may be separately inspected and the defective rejected, or pilot pieces are manufactured and inspected and the technique of manufacture varied upon the basis of the results of the test until so improved that every piece made is so satisfactory as not to require inspection, or to require inspection upon only a small fraction of the total number made. The manner in which these methods are used will vary according to the nature of the article made and the use to which it is to be put.

These non-destructive inspection methods are radiographic, electric and magnetic, and sonic. For steel castings and welds the radiographic has been used most extensively and has given greatest satisfaction.

The principle of radiographic methods is so well known through the use made of them by the medical and dental professions that no special description is necessary. A ray which will penetrate ordinarily opaque materials passes through the article to be inspected and falls upon a photographic film. Internal voids—gas holes, cracks,



Exposure times with 100 milligrams (1/10 gram) radium
Films. Eastman Contrast X-ray, two duplicate films to be viewed simultaneously
Intensifying screens: 3 lead sheets
Development: Twice normal time with potassium iodide added
Distance, radium to films, as indicated

Fig. 2—Exposure curve for gamma rays

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and so on—are registered as dark areas whose outlines show the true outlines of the internal voids.

The X-ray beam used for radiographic purposes, coming from an X-ray bulb operating at 200 to 250 kilovolts, is a beam made up of a series of wave lengths, varying from 0.25 to 0.07 $\times$ 10^{-8} cm. with an average wave length of about 0.15 $\times$ 10^{-8} cm. This wave length determines the penetrative characteristics of the ray; the shorter ray is the more penetrative.

The lengths of time necessary to obtain satisfactory radiographs are dependent upon the thickness (and nature) of the metal penetrated, the intensity of the ray, and the distance from the source of the ray to the photographic film. These times have been accurately determined for commercial X-ray bulbs of greatest power. Thus at a distance of 18 in. from source to film a time of approximately 50 sec. is required for 2 in. of steel, 20 min. for 3 in. and 800 hours for 6 in. This last

Fig. 3—X-ray radiograph of an irregular casting, 12 in. in length, showing sand inclusions

exposure time is too great to be practical; the practicable limit of thickness of steel for X-rays is about 3 in.

The quality of radiographs obtained with X-rays is remarkably good, and industry has found the method to be of the greatest utility in non-destructive testing. Some practical disadvantages must be endured, however, for the necessary apparatus is cumbersome and cannot be made portable except in a restricted sense.

Aware of the practical status of X-ray radiography, the staff of the Division of Metallurgy at the Naval Research Laboratory undertook a study of the use of the gamma ray from radium for radiographic purposes. The extremely short wave length of the gamma ray promised great penetration, and the simple radiographic manipulation of the gamma ray promised a number of important practical advantages.

The gamma ray is emitted spontaneously from radium and a series of other elements into which radium decomposes. It is a ray of light in no way different from X-rays except that its wave length is very much shorter, with an approximate average wave length of 0.01^{-8} cm. Physically, this much shorter wave length means that the increase in exposure time for increasing thickness of steel (illustrated previously for X-rays) should not be so great as with X-rays.

Either radium, held in a small metal capsule of the size of a small pea, or radium emanation, a gas which radium generates spontaneously, held in a small glass and metal capsule of equal size, may be used with equal effectiveness. If radium itself is used its radiating strength may be considered a constant with time, since 1,800 years are required to have its strength decrease to half its original value; if radium emanation is used allowance must be made for its fairly rapid decrease in strength with time, since its radiating strength decreases to half the original strength in four days.

The necessary equipment is thus merely the capsule containing the radium or the radium emanation, the object to be radiographed, and a photographic film held behind the object. This simplicity in equipment obviously makes it possible to perform radiographic exposures in almost any conceivable location, for everything is completely portable. Furthermore, this simplicity permits the method to be used by any intelligent workman.

The times of exposure necessary for gamma ray radiography have been accurately determined. The time of exposure to produce a satisfactory radiograph is determined by the quantity of radium used, the thickness of the steel, and the distance from radium to film. With reasonable quantities of radium, 0.1 to 0.5 grams, these times are all longer than those characteristic of X-rays, except above 3 in., but this can often be corrected by taking advantage of another favorable characteristic of the method. Since the gamma ray is of equal intensity spherically around the source, the possibility of taking many radiographs at one time should not be overlooked. These exposure times apply only to steel, but the exposure times for other materials, aluminum, brass, bronze, alloy steels, can be calculated from those given.

Fig. 4—Gamma ray radiograph of the same casting

Although this account is limited entirely to the radiography of steel, the method may be applied with equal success to other metals, except perhaps aluminum. Excellent radiographs have been prepared of brass and bronze castings.

These two practical advantages of portability and simultaneous radiography are illustrated in Fig. 1. The object is a large irregular casting. The radium was held very simply in a glass funnel in the rear of the casting, and 10x12-in. films were placed on the near side of the casting in the positions marked. Here seven 10x12-in. films were taken with one exposure, and it is obvious that had other castings been brought to the set-up, many more photographs could have been taken. Indeed, in some cases an arrangement has permitted taking fifty films at one time. It should be noted of course that this casting was radiographed just where it was found; it was not necessary to transfer it to the laboratory. Although the work seems quite open, it may be said that the dangers from personal exposure to the gamma ray may be avoided by following simple and well-known precautions (*AM*—page 651, Vol. 74). If the work is properly supervised, these dangers may be made entirely unimportant.

The type of radiograph obtained with the gamma ray

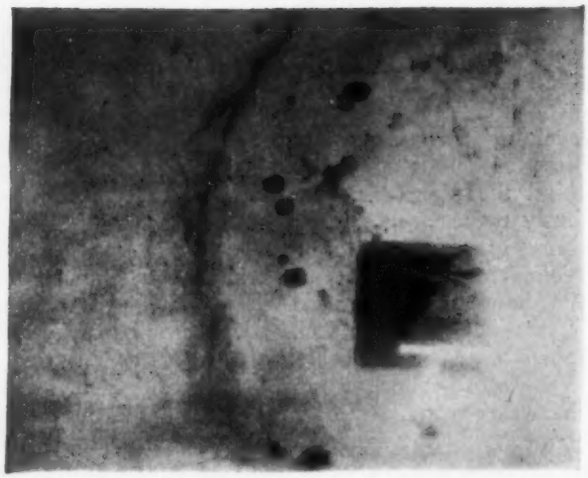


Fig. 5—Gamma ray radiograph of a steel casting 1¼ in. thick, reduced from the original 10x12-in. film

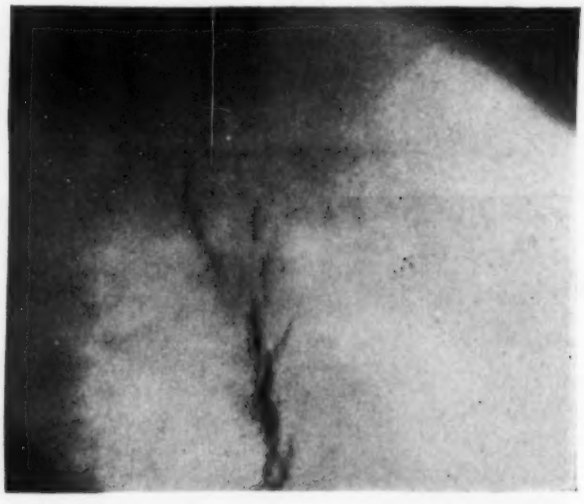


Fig. 6—Gamma ray radiograph of a thick steel casting, reduced from a 10x12-in. film

is similar in appearance to an X-ray radiograph. Comparative qualities of the two types may be seen in Figs. 3 and 4. The object radiographed was a small steel casting, with sand inclusions, 12 in. in length and of webbed design. The thinnest section was ¼ in. and the thickest, at the webs, 1¼ in. It will be noted that the contrast in this X-ray radiograph is superior to that on the gamma ray radiograph, yet no defect can be found on the X-ray film which can not independently be found on the gamma ray film. Furthermore, it will be noted that all parts of the casting are correctly exposed in the gamma ray film, including the heavy webs; whereas the webs are badly underexposed on the X-ray radiograph. This lack of sensitivity to changing cross-section is characteristic of the gamma ray method and constitutes one of its chief practical advantages.

Shortly after the development of this new method, the Laboratory was called upon to prepare radiographs of a defective stern-post casting on the U.S.S. Chester. This task was carried out in drydock at Norfolk, and 24 radiographs of various sections of the casting were prepared. The work furnished valuable information concerning the quality of the casting and also illustrated the application of the method.

Fig. 5 is one of this set of 24. It may be seen that the metal—1½ in. thick—was in a very poor condition, for numerous voids and general porosity are evident. The feature, however, is a crack, running from one film to the other, more than 20 in. in length. This crack opened up during the trials and illustrates the general condition of the casting, which led to its complete fracture during final trials and to its ultimate replacement.

The great penetration of the gamma ray is well illustrated by a series of radiographs taken of a very heavy keel knuckle casting; Fig. 6 is one of this series. The thickness of the steel at the lower left of the radiograph was 7 in., at the upper right 3 in. A system of jagged cracks may be seen throughout this section. The long crack on the left occurs in a thickness of 5 in., far beyond the X-ray limit of thickness. It also may be noted that

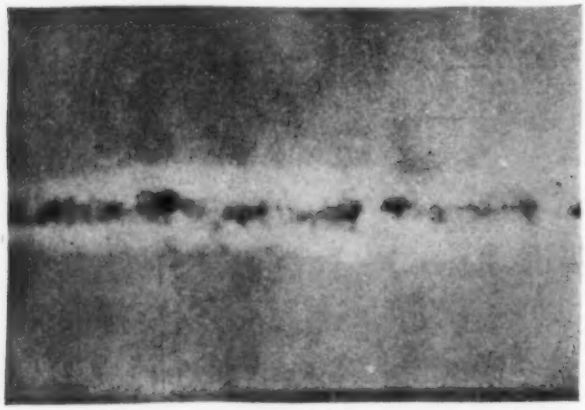


Fig. 7—Gamma ray radiograph of a porous butt weld in 1-in. plate

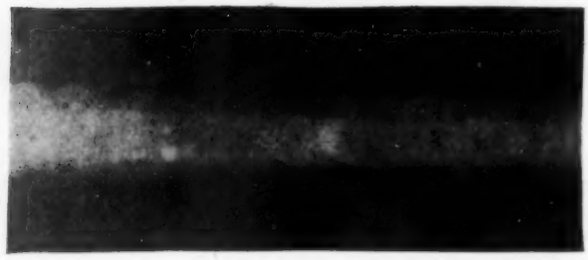
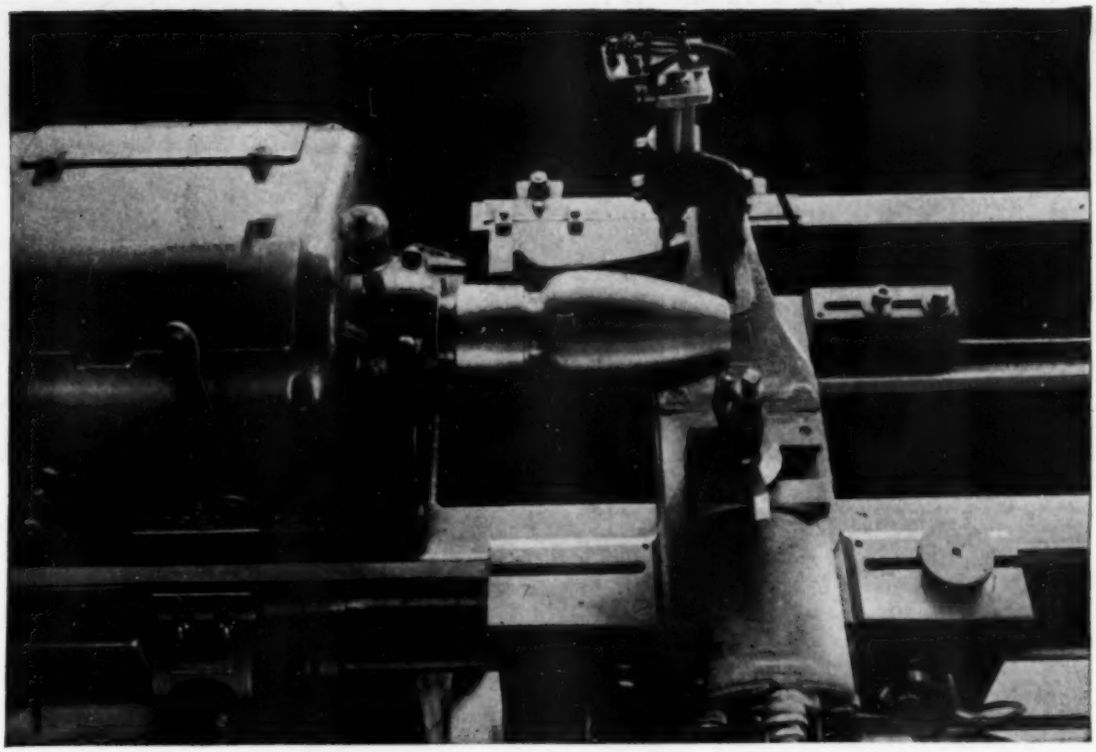


Fig. 8—Gamma ray radiograph of a good butt weld in 1-in. plate

the drastically changing thickness did not result in underexposure or overexposure anywhere, the gamma rays giving an exceptionally uniform exposure.

The method has been less thoroughly tested on welds. Sufficient work has been done, however, to justify full confidence in its application in this field. Fig. 7 shows a badly porous butt-weld in steel plate 1 in. thick. Fig. 8 shows an entirely satisfactory weld of the same type. The sensitivity of the method for fine defects of the type found in welds has been experimentally demonstrated as better than 2 per cent of the total thickness.

It appears, therefore, that this new non-destructive method of inspection offers several advantages. Still very new, its adoption by industry is in the future, but with the ever-increasing demands for quality, and the possibilities it presents of inspecting far greater thicknesses than heretofore feasible, its adoption seems certain. Indeed, the Navy is now considering the purchase of a half gram of radium to be kept at the Naval Research Laboratory and to be sent to the various yards on the East Coast as needed for radiographic inspection purposes.



Turning the body of a bronze vase in the plant of the Gorham Manufacturing Company. Such a method allows full play to artistry with a fraction of the usual cost

Turning by Templet

THE law of transfer of skill reads thus, "The attention and skill required to use a tool or operate a machine is inversely as the skill transferred into its mechanism." There was a time when the tool and the machine were adjuncts to the skill of the mechanic. That condition has been changing for years, and as far as straight manufacturing goes, the transfer of skill into machines and mechanisms has made the skill of the worker an adjunct to the machine and its tooling.

The invasion of transferred skill to tool room machinery is exemplified by the Keller automatic die sinker. This is an electrical adaptation of the pantograph principle whereby from one pattern a single or many duplicates are produced. The engraving machine is one example of this. Others are the multiple wood carving machine, and the multiple signature pantograph.

The automatic die sinker is a milling machine, but its electric control is equally adaptable to a lathe. The same principle was carried out in applying the Keller electrical control unit to all sizes of Monarch lathes. The engineers of the two companies worked out details of the application of these controls so that they are built in, and form a complete unit.

When this machine was first introduced there was speculation among shopmen as to just where its field of greatest usefulness would be found. Apparently this field is to be just where it was wanted the most—in the tool room, for the forming of difficult shapes.

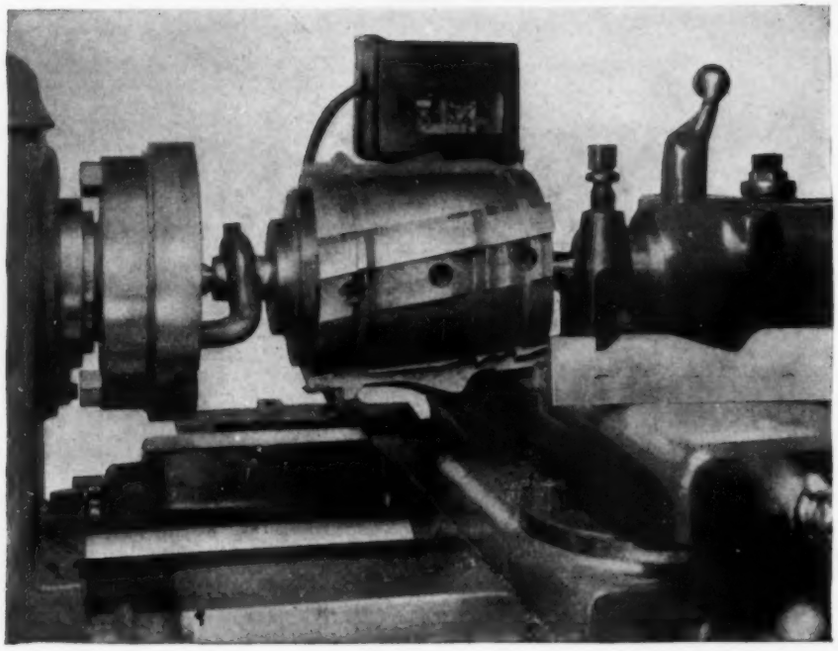
Industry is changing. The designing engineer has been turned loose, and instead of confining his designs to those forms the shop is prepared to make without much trouble, he has consulted sales appeal, called in the artist, and left it to the toolmaker to reproduce his artistic designs as best he could.

The toolmaker has met this challenge to his skill, but the number of highly skilled men capable of such work is limited, and development has been slowed up. Thanks to this new machine the engineer and the artist can now revel in curves and symmetrical shapes. In fact one of its first uses has been to turn artistic bronzes in the plant of the Gorham Manufacturing Company whose product is famous for its artistry.

Part of the skill transferred into the mechanism of the forming machine must be in the form of templets, and a technique will have to be developed that is much more accurate than that necessary for die-sinking purposes. The reason for this is that, in the die sinker, no attempt is made to get a finished surface. A scraper, a flexible grinder and a few bent files take care of milled work, but the same method cannot be used on internal surfaces of bottle molds and similar work.

The tracing member of the Keller control is accurate to within 0.001 in. Such sensitivity means that if the templet is not filed or adjusted parallel with the axis of the lathe the part turned will be tapered. If there are unintentional hills and dales in the profile, the tracer will follow them and faithfully reproduce them in the finished mold. The finish and regularity of contour on the parts

Templets, some of which show abrupt changes in direction and all of which are faithfully reproduced in the work



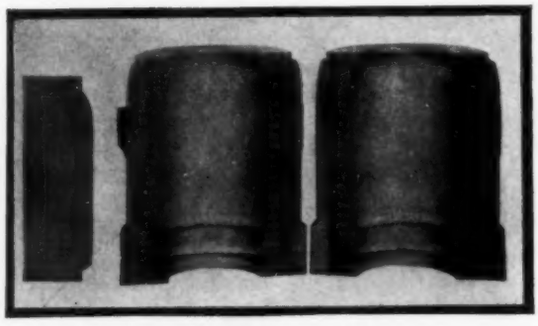
The machine handles either chuck work or work held between centers. Formed cutters can be roughed out in the conventional way, a couple of levers thrown and the contour is finished automatically. This cutter is a six-hour job

is often remarkably good, but it still follows that the finish secured is proportionate to the skill in filing the templet.

As the use of such machines increases it is evident that an automatic templet machine will be the next logical step, or possibly a tracer that will follow the correct lines on a blueprint, and eliminate the necessity for a templet. This dream is not as impossible as it might seem. Pantographic machines used for engraving textile printing rolls are guided by lines drawn on a zinc plate by hand.

The templet is clamped to what would normally be the taper attachment guide of the lathe. Shoulders are provided so that the templet will be square with one of the major axes. The tracer is mounted on a bracket and is in fixed relation to the cutting tool. The contour of the templet is reproduced by either simple or compound movements of the cross and longitudinal feeds. The control cabinet is flexibly connected and can be placed in any position that is convenient for the operator.

The normal use of the machine is not interfered with, no matter for what purpose it is used. If used non-automatically, it is a standard lathe with all the feeds and speeds regularly furnished. Throwing three levers converts it into an automatic forming machine, with everything disconnected except the manually operated feed screw on the compound rest, which is used to control the depth of cut or to take successive cuts.



Bottle molds become routine work, no matter how many curves there are

It is evident that a valuable feature of such a machine is that two molds, or two of anything else, made from the same templet, will be duplicates regardless of whether the same man makes them, and regardless, too, of the time lapse between the machining of the first and last.

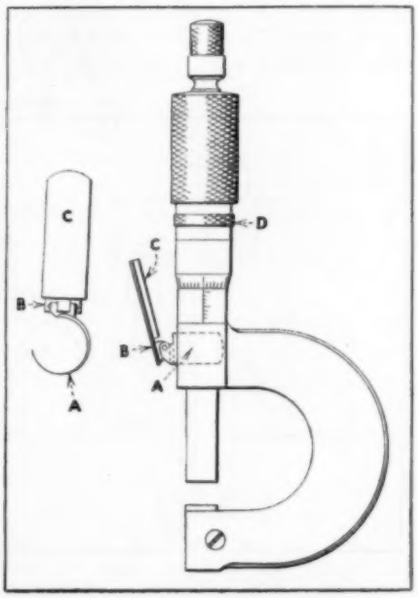
Ideas from PRACTICAL MEN

Reflecting Device for Micrometers

GEORGE J. MURDOCK

In doing work on the surface grinder, it is often difficult, if not impossible, to read a micrometer without taking it from the piece being operated upon, thus losing the "feel," because the wheel or other parts of the machine are in the way. Also, in grinding or lapping small work, such as gages, it is often desirable to read the measurement while the micrometer is still on the work. To be able to read the measurements from a vertical position, the simple device illustrated was designed. It has been found helpful, not only in bringing the divisions and the figures on the micrometer directly under the eyes without tilting the head to one side, but also as a reflector where the light is poor.

A plan view of the device and also a view showing it attached to a micrometer are given in the illustration. The device comprises the small clip *A;* the steel plate *B* hinged to the clip in such a manner that it will stay in any position in which it is set; and the small mirror *C*, cemented to the steel plate. It is so constructed that it can be turned around the top of the micrometer frame so as to show better the graduations and the figures on the thimble and the sleeve. The device is used on the micrometer frame for measurements of ½ in. or less, but when the micrometer is open more than ½ in., it is slipped on the sleeve, where the clip holds it securely in any desired location.



The hinge allows the mirror to be adjusted to the right angle to best show the divisions and the figures on the sleeve and the thimble, when looked down upon, and when the thimble is in a vertical or a nearly vertical position, and the spindle is on the work. The reflection of the light from an electric lamp, or from daylight, permits easy reading of the measurement without disturbing the exact "feel," which is important on accurate work.

It will be noted that the figures on the thimble are shown in the mirror reversed, which to the beginner is confusing. Means are therefore provided to correct this condition. A thin sleeve *D* having a hole on one side is split nearly through the hole by a thin saw, thus giving it sufficient tension to hold upon the thimble, wherever placed. The line made by the saw cut serves to locate the sleeve in line with the zero mark on the thimble. The numbers on the sleeve are etched in an inverted position, and therefore show right-side up in the mirror. When it is desired to use the sleeve, it is slipped down so that its bottom comes even with the beginning of the bevel on the thimble, thereby covering up the numerals on the thimble, but showing those on the sleeve. When not in use in connection with the reflector, it may be drawn up out of the way, as shown. The reflector may be used with any standard micrometer, and will be found a useful adjunct for use on many classes of accurate work.

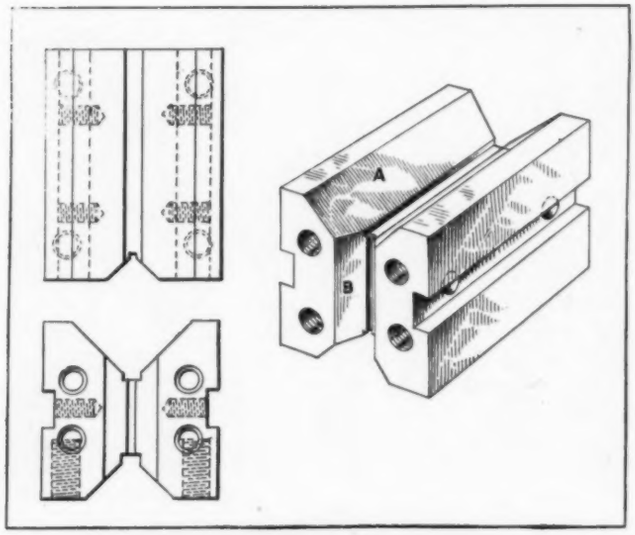
Toolmaker's V-Blocks With Jig Features

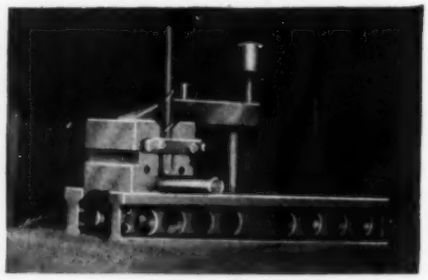
ARTHUR G. CARPENTER

Instructor in Machine Department, Wentworth Institute

To the toolmaker, who likes to make useful tools of his own and has the privilege of doing so, I suggest that he make a pair of hardened and ground V-blocks of the type shown in Fig. 1. It will be noted that there are V's across the ends as well as on the top and bottom. Also that there are some conveniently-spaced tapped holes for attaching suitable clamps.

I have found such V-blocks most useful in drilling crossholes in small round work. The work can be clamped in the longitudinal V at *A*, while a suitable drill bushing can be clamped in the end V at *B*, either by a strap or by toolmaker's clamps. All V's being ground centrally, the drill bushing will be directly in line with the axis of the work. Accurate location of the hole from the end of the work can easily be secured by measuring with a depth micrometer from the end of the work to the bushing, making allowance for one-half the diameter of the bushing. With the block set on parallels, the work





being below and the bushing above it, as indicated in the set-up in Fig. 2, the work can easily be drilled.

The V-blocks were made of machine steel 1¼ in. square, and are 1¾ in. long. They were roughed out in the shaper, drilled and tapped, pack hardened, ground square on a surface grinder, and then lapped. To grind the V's in the center, the blocks were placed end to end in a standard V-block and one face of one longitudinal V was ground. Then the blocks were turned around and the other face of the V was ground, using the same dial setting of the wheel head. Finally, finishing cuts were taken on both faces or the V at one setting of the wheel head. The other V's were finished in the same way.

Threading in a Radial Drill—*Discussion*

J. T. TOWLSON
London, England

The improvization of the radial drill for rectifying worn threads in large holes, as described by Ed. C. Rendler in an article under the title given above (*AM*—Vol. 74, page 731) is good. In my opinion, a more considerable adaptation of the radial drill to similar work would be a decided advantage to production.

As a machine shop foreman, I have used the same method for a considerable time. While it is true that my device is considerably more elaborate than the one described by Mr. Rendler, the essential feature is precisely the same. It was used by me for cutting Whitworth threads in heavy work, such as the steel bosses of large built-up propellers. The diameters of the holes varied from 2½ to 3½ in., and of course, with a single chaser bar all threads were of the same pitch.

As is well known, the holes in propeller bosses are generally blind, and for threading a blind hole, a bar such as described by Mr. Rendler could not be used. Moreover, to thread a blind hole it is necessary that a substantial clearance or recess be cut at the bottom, so that the threading tool may be run into it with safety against breaking. We possessed a tool for making such a recess, and it, too, was held in the radial drill. There is one point in regard to Mr. Rendler's method that could be vastly improved. The tool bar should act as a pilot in the hole to be threaded to guarantee that the thread will be cut to a regular depth all around. With a bar like Mr. Rendler's, and with such heavy work to negotiate, it would not be an easy matter to guarantee that regularity of depth.

My bar had a detachable pilot of a diameter that was an easy fit in the hole being threaded. Moreover, a difficulty that I am sure Mr. Rendler must have met with was that on reversal of the machine, with no relief, the cutter must have been damaged. There is a way of attaching a swinging cutter at the base of the pilot, so that when pivoted eccentrically on such a base the cutter may be fed gradually into the metal, and at the same time provide a means for automatic relief when the machine is reversed. It will be agreed that such a relief is necessary, especially when dealing with steel. In support of my contention that greater advantage should be taken of the radial drill for such work as heavy threading, a considerable area of the job in hand can be reached by the radial arm, so that many holes may be threaded at one setting of the work.

Beading Tools of Simple Design

JOHN J. MC HENRY

Often tools for certain work are so designed that the operations are difficult and slow, making promised dates of delivery impossible. The designer must plan tools that he is certain will function properly. Regardless of what he may deem simpler and easier, lack of time forces him to adopt the more certain methods of his previous experience.

As an instance, the tools shown in Fig. 1 are for forming a bead on the closed end of the shell indicated by heavy dotted lines. The shell was formerly bulged in a split die, using rubber to do the bulging. By the use of

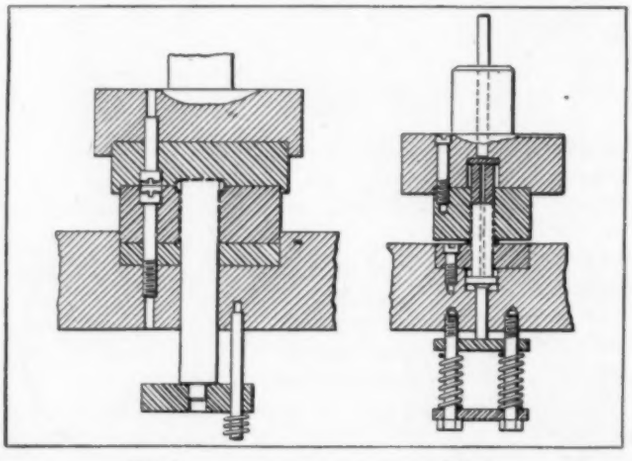


Fig. 1 Fig. 2

Fig. 3

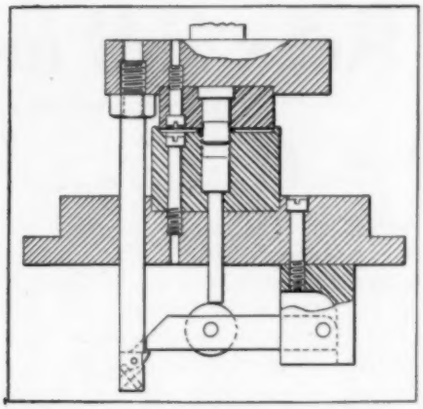
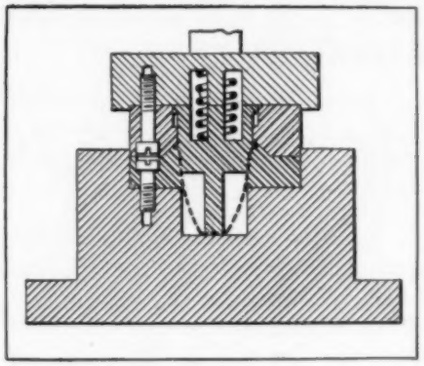


Fig. 4



the simple tools illustrated, the frequent replacing of a moulded rubber was eliminated. In drawing the shell, the corner at the closed end is rounded. Placing the shell of the spring-actuated plug in the center of the die-shoe as the punch descends both the shell and the plug recede until the open end of the shell bottoms in the die. As the punch continues its descent, the metal is forced to bulge by the shape of the tools, filling the pockets in both the punch and the die. As to why the shell bulges—it just can't do anything else, being completely housed. The plug acts both as a guide and a stripper. Air holes through both the upper and the lower members are important for the proper functioning of the tools.

The tools shown in Fig. 2 are for forming a bead near the open end of a shell, while those in Fig. 3 are for beading a shell that is open at both ends. The diameters of the beads can be held closely to size by care in trimming the shells to length. In both cases the shells stick in the dies and are knocked out by the center plugs, which also act as anvils. The knockout bar in Fig. 2 is spring operated, while that in Fig. 3 is positively operated by a rod connected to the punch-holder.

Tools for beading the open end of a formed shell are shown in Fig. 4. The shell is drawn so that the upper part is straight and is then trimmed to length. The operation is one of closing in to form an angular bead. Many designers would have arranged to perform this operation by rolling. The punch is, of course, machined to the angle required for the bead, and the action is one of turning over the straight wall of the shell.

In all beading operations there is the traditional "nigger in the wood-pile," and it is the temper of the metal. We experienced difficulties before getting the job licked by having the shells crumple or become wavy. This condition has been totally eliminated by annealing the shells at the proper temperature, so that the redrawing operations would give them the correct amount of stiffness. The temper of the metal must be determined to suit the individual job. The number of drawing operations, how often the work must be annealed, and the temperature of annealing must be found by trial.

Handling Oversize Work on the Planer
Discussion

D. Q. DUNSTONE
Hetton-le-Hole, England

I have read with interest the article by W. B. Lincoln, Jr., under the title given above (*AM*—Vol. 74, page 694). In machining work similar to that described by Mr. Lincoln, we find it more expedient, before planing the top in two sections, to cut a tool clearance across the face to be planed, doing this part of the work in the shaper. Approximately $\frac{1}{32}$ in. is left at the bottom of the clearance cut for finishing on the planer. To plane this face without clearance may result in the movement of the work on the table, or in the destruction of the tool.

In respect to machining the end of the casting the application of the method followed by Mr. Lincoln, to heavier castings or to jobs of greater length, may result in a radial movement of the work, due to its overhanging weight, the momentum of which would have to be overcome at each reversal. The arrangement of the blocking would be useful, but the end of the work should be machined in the slotter.

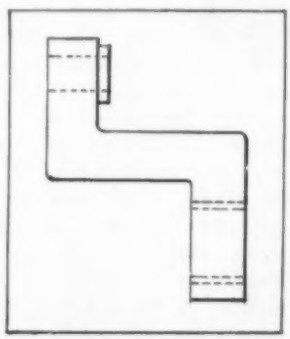
Jig With a Floating Work Holder
Discussion

DONALD RAEBURN
Glasgow, Scotland

In an article under the title given above (*AM*—Vol. 74, page 693), H. R. Schmidt describes a jig in which the work can float but cannot revolve. He states that the work had originally been done in a turret lathe, the reamer being held in the turret, but that the result was not satisfactory.

There is no reason why the boring and the reaming could not have been accurately done in the turret lathe with the reamer held in the turret, and the hole be concentric with the outer diameter and square with the sides. If the chuck jaws are true and the reamer is in good condition, and is correctly held and supported, the work could be accurately reamed in correct relation to its sides and its outer diameter. It would be advisable to use two reamers, one a rose shell reamer to bring the bore to within 0.005 in. of size; the second reamer to finish size the bore.

Both reamers should be supported by steady brackets as per the accompanying sketch. The brackets should be secured to the turret faces in correct axial alignment, the reamers projecting a sufficient amount only to finish the bore and to clear the chuck jaws. This method of doing the work would eliminate the necessity for Mr. Schmidt's jig, the ingenuity of which must be admired. If a jig is considered necessary, Mr. Schmidt will find one described on page 79 of the *American Machinist Shop*

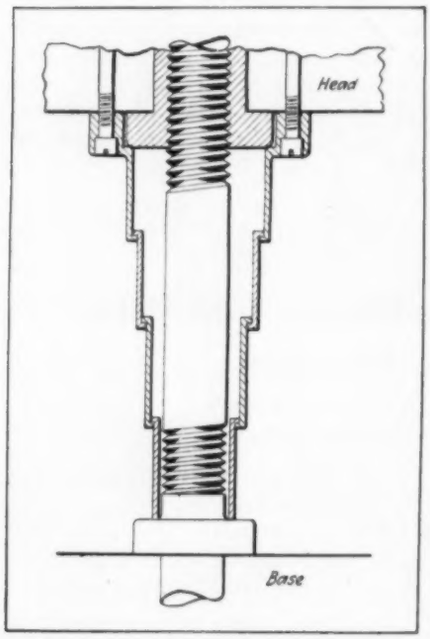


Note Book that was designed for such parts, and that will fulfill all requirements. This book contains a careful selection of methods and devices used by machinists in all parts of the world.

Telescopic Protectors for Screws

WM. C. BETZ
Master Mechanic, Fafnir Bearing Company

The bronze nut for the operating screw of our Riehle testing machine had to be replaced at frequent intervals because of excessive wear. For quite a long time, we were unable to determine the cause. At last, we discovered that in breaking specimens of hardened steel in crushing tests, small particles would fly with enough force to imbed themselves in the screw. Acting as boring tools, the hardened steel pieces would soon bore the threads out of the nuts.



It was impossible to smooth the screws without picking or chipping out the particles of steel, which took time and patience, and in some cases ruined the screw, requiring a new one to be made. To prevent a recurrence of the trouble, we made the telescoping bushings shown in the illustration. When in place, they covered the screws at all times, so the flying particles could do no damage.

An Eyesight Saver

ROBERT S. ALEXANDER
Universal Winding Company

While in a jewelry manufacturing plant the other day, I saw a surface gage being used in what, to me, was a novel and ingenious manner. One of the toolmakers—a craftsman of venerable aspect—was filing a piece of work of intricate design. Directly over the work and greatly facilitating his control over his file, was a large reading glass securely impaled by its wooden handle on the scriber of a large surface gage. The base of the gage was attached to the bench by a small clamp to offset vibration. The glass could be brought into any position by the usual adjustments of the spindle and the scriber. Later, I employed this useful device while cutting fine threads in the lathe and found it very useful.

SEEN AND HEARD

JOHN R. GODFREY

A Fast Worker

WHAT is the fastest rate at which you ever saw a person work at manual labor? My own experience in this line occurred during a trip on the Great Lakes. Somewhere up in Superior the boat ran into a harbor, and I took advantage of the stop to visit a large saw mill near the landing. I don't remember where the place was, but the mill handled only cedar as far as I could see. At the tail end of the lumber line was a gang saw for ripping lath. The edgings used would make anywhere from three to six laths, any piece making less than three being rejected.

These edgings were fed to the gang saw at the rate of one each second or 60 a minute. The laths produced were classified as class A. B, or C, depending upon their evenness and freedom from knots. There was also, of course, one piece of scrap to every edging.

Taking the lowest possible number, which is three laths and one piece of scrap, 240 pieces of wood came from the gang saw each minute.

The "take-off" man sorted the laths and placed them in three different parts of the rack over which he bent, and threw the scrap down a chute at his left. Three boys tied for him. The task was much harder because of the sorting, which killed any possible rhythmic movement.

Making Shop Visits Pay

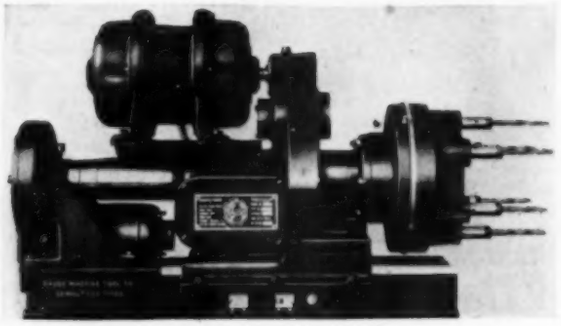
A FRIEND who is responsible for results in a big plant makes at least one trip a day through the shops. Reports may show him how much work went through, but he wants to see for himself how it goes through. As he puts it he means to make his shop visits pay for the time taken by finding something that can be improved. This adds zest to the job, and some rather surprising results have been accomplished, many of them entirely unexpected. Just as an example he noticed a bandsaw man brazing saws from new strip saw stock, and noted a number of lengths with a variation of only a few inches. He found that the band wheels had quite a wide adjustment and that two or three lengths could be used on them all. A clear case of simplification that can be accomplished more often than we think.

What is your batting average on making shop visits pay?

A Jumping Gantry

The necessity of jumping gaps in railroad tracks, because the villain has removed a rail or a bridge has been burned, usually happens only in wild and woolly novels. But the idea has its counterpart in the jumping gantry in a big shipyard in Virginia. It was highly desirable to have a gap in the gantry track, so four wheel trucks were designed with the wheels so spaced that three of them were always on the rails while crossing the gap. It is an idea worth tucking away in any plant engineer's note book.

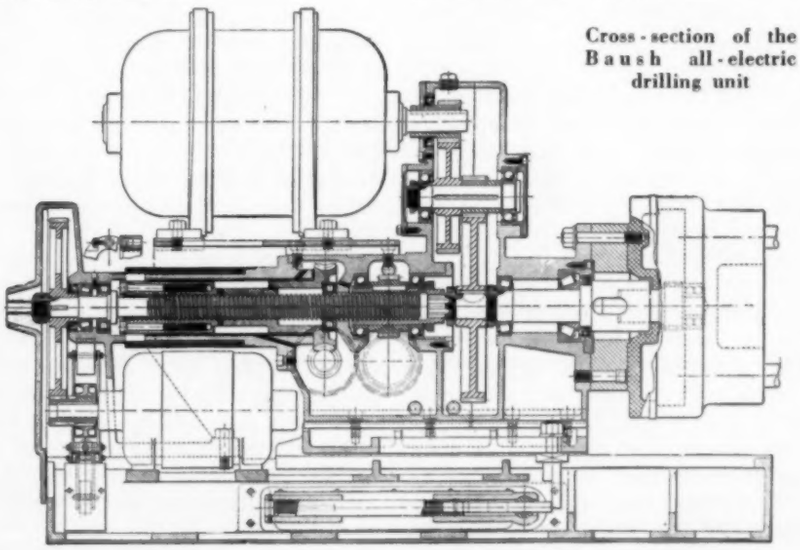
SHOP EQUIPMENT NEWS



Baush Electric Center-Feed Drilling Unit

This unit is in addition to the line of fixed and adjustable center multiple-spindle drilling machines of the Baush Machine Tool Co., Springfield, Mass. Features of the unit are its compactness, its center feed and the fact that it is an all-electric machine. Its head is provided with a quick forward motion, a positive, uniform center feed and a quick return to starting position. All these movements are automatic and yet may be controlled by the operator by means of a four-push button station providing stop, start, inch forward or backward, or reverse head travel in either direction. This unit, like other drilling units, may be mounted singly or multiply in horizontal or vertical positions for drilling, reaming, spot-facing or boring. It can be arranged for tapping at a slight additional cost. It is furnished in various sizes, the one illustrated being known as the No. 3 and having a capacity of one 1½-in. drill or six ⅝-in. drills, or equivalent, for drilling cast iron.

In the machine illustrated, a 3-hp. motor drives the main spindle through spur gearing. This spindle can operate a single drill or any of the standard multiple drilling heads. The drilling speed is changed by changing the gears. The feed is changed by changing the pick-off gears. Since these gears are mounted on splined shafts, the operation consists only of taking off the cover, fastened by two screws. The feeding pressure is directly in the center of the drilling area and is accomplished by rotation of the feed nut. This is a patented Baush feature. The head may be manually-operated for tool adjustment by using a crank applied to the end of the screw. Movement of the head, that is quick approach and return, and the feed, are quickly and accurately adjusted by means of dogs. There is also an adjustment which takes up wear on the feed nut. This can be accomplished without disassembling the machine and prevents the drills from "hogging in."



Cross-section of the Baush all-electric drilling unit

Quick approach and return are accomplished by an entirely separate motor, which operates the screw, instead of the nut, through gears. There is an electric brake which releases when the motor starts. This holds the feed screw stationary and makes the stopping of the quick approach "snappy."

All mechanism is completely inclosed and all adjustments can be made simply and without disassembling. Anti-friction bearings are used throughout. All switches and electrical coils are contained in one sliding drawer which can be pulled out for inspection.

Oilgear Type QR-2 and QWR-2 Variable-Delivery Pumps

Two styles of pumps with working pressures up to 1,500 lb. per sq.in. are being manufactured by the Oilgear Co., Milwaukee, Wis. The Type QR-2 is a one-way, variable-delivery pump, having a capacity from 60 to 1,650 cu.in. per min. at a speed of 860 r.p.m. Type QWR-2 is similar but in addition has a constant and variable-pressure control from 500 to 1,500 lb. per sq.in. The former type is for use with cylinders and machines performing broaching, assembling, grinding, honing, planing, drilling, boring and similar work where it is essential to have a smooth straight-line motion. The latter is for use with machines performing assembling, squeezing, clamping and riveting work and in similar equipment where it is necessary to hold the work under a predetermined pressure for a period of time. Both of these

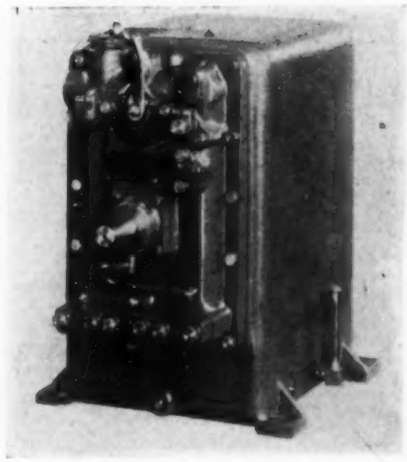


Fig. 1—Oilgear Type QR-2 One-Way Variable-Delivery Pump in standard oil casing

units can be used in combination with an Oilgear constant-displacement fluid motor as variable-speed transmission.

Both pumps are of the multiple-plunger type, operating on the same principle as other Oilgear units. Oil is delivered in one direction only. A control valve must be used for reversing the flow of oil from the pump to a reciprocating cylinder or rotary motor. The amount of oil delivered is controlled by a lever located near the top of the pump, which varies the eccentricity of the multiple cylinder block with relation to the fixed piston carrier. In the Type QWR-2 pump full volume is delivered up to the pressure at which the control is set, when the stroke is reduced automatically to a point where the pump is delivering only sufficient oil to maintain that pressure. A relief valve is provided.

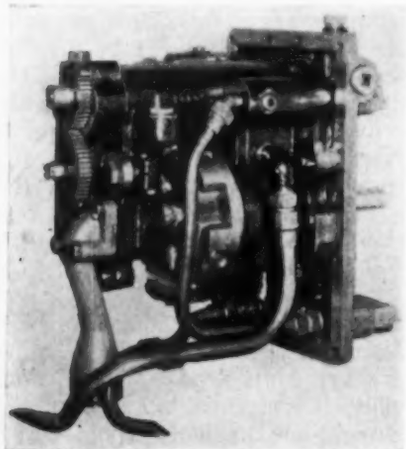


Fig. 2—Internal view of the Oilgear Type QR-2 Variable-Delivery Pump on its mounting flange. The swinging pendulum and control gear segments can be plainly seen

At full stroke and load these pumps have an efficiency of 90 per cent. Thrusts are carried on roller and ball bearings, and the working parts are easily accessible. An internal-gear pump supercharges and lubricates the high-pressure pump at all times. Both pumps are mounted on a flange and can be built into machines. When so installed, an oil reservoir must be provided. The pump can also be furnished with a standard oil casing having mounting feet or with a large combination oil reservoir and base arranged for direct motor drive. Under ordinary conditions a 3- to 5-hp. constant-speed motor is sufficient for drive, with a 7-hp. motor as the maximum.

Pumps similar to the above, having a maximum working pressure of 2,500 lb. per sq.in., are also being built by the company.

"Rego" Type CC Cutting Torch

A light-weight cutting torch has been announced by the Bastian-Blessing Co., 240-258 E. Ontario St., Chicago, Ill. The weight of the torch is 46 oz. with tip attached, and over-all length is 20¼ in. from base of handle to end of tip nut. Wide adaptability as to fuel gases and range are claimed to be characteristic of the new model. Close grouping of the preheat holes and concentration of the preheat flame is claimed to produce a narrow clean kerf with little slag adhesion to the lower surface and sharp square upper edges. Tips for use with the various gases are of one-piece construction from solid copper bar stock. Preheat holes are closely grouped and straight drilled one size the full length, in order that repeated refacing will not change the hole size. A long tapered seating surface is used in the tip head in order that only slight tightening of the tip nut is necessary to insure a tight joint in the torch head. Tips for use with oxy-acetylene are obtainable in various types for special purposes, such as general cutting, cast-iron cutting, plate cutting, sheet-metal cutting, billet gouging or de-seaming and rivet washing. Tips for use with liquefied petroleum gases, for use with city or by-products coke gas, are of two-piece construction, having a brass core with a pure copper protection and recess sleeve which is readily removable for cleaning.

Torch heads are of drop-forged Monel metal, permanently assembled to the seamless drawn Monel metal torch tubes. They are furnished in four angles, 90, 75, 35 deg. and straight tips, and head and torch tube assembly are interchangeable with any CC torch handle. The Monel metal is claimed to be sufficiently hard so that grit or dirt will not readily affect the seating surface but will rather become imbedded in the softer copper tip seat, thus saving repairs to the head. The tip nut is made of brass and of comparatively light section so that excessive tightening

which might damage the seat or threads of the head will transfer the damage to the tip nut.

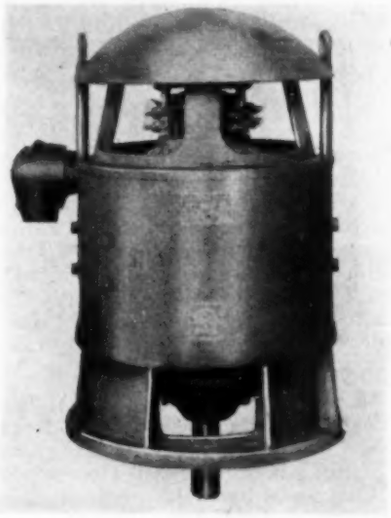
The mixer head, of forged brass, is located at the front end of the torch and serves as a means for securing the torch tubes and inclosing the mixer which is an independent unit readily removable. The handle is of heavy-gage brass tube deeply knurled to insure easy grip.

The valve body is a brass forging with oxygen and acetylene preheat control valves and high-pressure cutting valve machined integral with the body. The assembly is so designed that the high-pressure oxygen has an almost straight-line flow through the valve, thus reducing pressure losses and increasing torch capacity.

The seat is of special composition, permanently assembled in an inexpensive seat holder. The valve stem is of Everdur bronze. The high-pressure valve lever is made from high-strength drawn stainless steel in one piece. It is furnished in two positions, on the lower side of the handle for operation with the third and small finger or at the side for operation with the thumb.

Reliance D. C. Vertical Motors

Type T, d.c. motors for vertical application in sizes up to 50-hp., 1,150 r.p.m., have been placed on the market by The Reliance Electric & Engineering Co., Cleveland, Ohio. These motors are provided with a ring base for mounting and a drip cover to protect them from falling dirt and chips and from dripping water, oil or other injurious solutions. Where it is desirable to do so, the motor can be mounted directly on the machine without the ring base, and will thus ap-

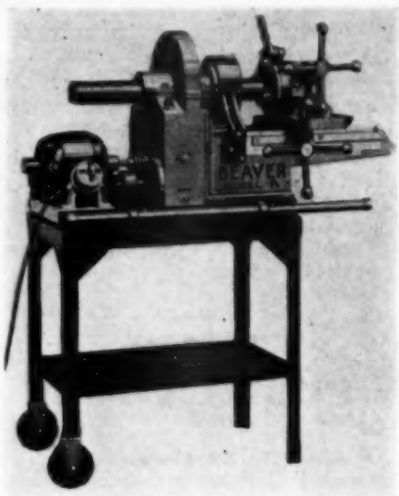


pear as an integral part of the machine. Large bearings are used to take up the thrust load, or weight, of the armature.

Beaver Model A Pipe Machine

The Beaver "Model A" pipe machine, capable of cutting, threading and reaming ½ to 2 in. pipe of steel, wrought-iron, brass or cast-iron has been produced by the Borden Co., Warren, Ohio. Three opening dieheads are supplied including ½ by ¾ in., 1 by 1¼ in., and 1½ by 2 in. Dies are adjustable for over, under or standard threads. It is not necessary to back off over finished threads, a feature which insures economy in operating time and die replacement. The cut-off follows the design of the patented square-end pipe cutter.

The unit has a ½-hp. universal motor, reversible at the switch. It is connected to the machine with a flexible coupling. The machine may



be operated from a 110-volt light line.

The oil pump is mounted on the outside for convenience in repacking and cleaning. All main housings are of aluminum, thereby affecting a saving of 125 lb. in weight. The diehead can be tilted back out of the way when cutting and threading up to 12 in. using a Universal shaft and geared die stocks and pipe cutters.

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AUGUST 4, 1931

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Rate Change Device. Edward J. Kearney, Wauwatosa and Robert S. Condon, Milwaukee, Wis., assigned to Kearney & Trecker Corporation. Patent 1,817,036.

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Chaplet. Charles H. Reeder, St. Louis, Mo., assigned to Reeder Manufacturing Co. Patent 1,816,870.

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Snap Thread Gage. Paul V. Miller, Woonsocket, R. I., assigned to The Taft-Peirce Manufacturing Co. Patent 1,817,637.

Die of the Extruding and Wire Drawing Type and Process of Making the Same. John T. Pratt, New York, N. Y. Patent 1,817,680.

Chuck. John J. N. Van Hamersveld, Cleveland Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,817,721.

Indicating Device. John J. N. Van Hamersveld, Cleveland Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,817,722.

Indicator. John J. N. Van Hamersveld, Cleveland Heights, Ohio, assigned to The Warner & Swasey Company. Patent 1,817,723.

Indicating Device. John J. N. Van Hamersveld, Cleveland Heights, Ohio, assigned to The Warner & Swasey Co. Patent 1,817,724.

JULY 28, 1931

Processes

Method of Casting Metals and Alloys Therefor. Walter C. Smith, Moylan, Pa., assigned to Allied Process Corporation. Patent 1,812,992.

Process of Case Hardening. Roysel J. Cowan and Philip W. McCoy, Toledo, Ohio, assigned to Surface Combustion Corporation. Patent 1,813,028.

Method of and Apparatus for Magnetic Testing. Carl Kinsley, Scarsdale, N. Y., assigned to Magnetic Analysis Corporation. Patent 1,813,746.

Annealing Magnetic Punchings. Lee E. Hildebrand, Marblehead, Mass., assigned to General Electric Co. Patent 1,813,802.

Manufacture from Sheet Metal of Pointed Fastening Devices. Frank Humphris, Parkstone, England. Patent 1,813,805.

Process of Producing Protective Metal Coatings. Colin G. Fink, New York, N. Y., and Charles H. Eldridge, Metuchen, N. J., assigned to United Chromium, Incorporated. Patent 1,813,842.

TRADE PUBLICATIONS

BALL AND ROLLER BEARINGS. The Bantam Ball Bearing Co., South Bend, Ind., has issued manual No. 11 on its line of ball and roller thrust and radial bearings. For the first time dimensions and load capacities of heavy-duty-type roller bearings up to 29½ in. bore and 48-in. O.D. are published. Special bearings are also illustrated, as well as recommended mountings and enclosures. Engineering data are appended.

CHAIN DRIVES. The Morse Chain Co., Ithaca, N. Y., has issued a new catalog on Morse Silent Chain Stock Drives, numbering it No. 44. The 56 pages of the Bulletin give the buyer necessary information for the selecting of the type of drive required and the price. It is arranged in convenient tabular form.

CIRCUIT BREAKERS. The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces the publication of circular 1921, covering Types GO, GO-1, and GO-2 oil circuit breakers, a line of low-capacity outdoor breakers for use in distribution or low-voltage transmission systems. Construction and operation details, style numbers, and a number of illustrations are included.

CUTTING TOOLS. The Production Tool Co. of America, Detroit, Mich., has issued a new catalog under the title "Production Tools," describing the line of counterbores, spotfacers, countersinks, holders and inserted blade cutters manufactured by the company.

FURNACES. Ryan, Scully & Co., 3711 Wissahickon Ave., Philadelphia, Pa., has published bulletin No. O-3H, describing and illustrating R-S oil-fired pot-type furnaces, using round or rectangular pots, Types A and B.

GASKETS. The Victor Mfg. & Gasket Co., 5750 Roosevelt Rd., Chicago, Ill., has issued Catalog H on gaskets, gasket materials and packings, containing 94 pages of information on the company's gaskets and similar products.

LAMP CHARACTERISTICS CALCULATOR. The General Electric Co., Nela Park, Cleveland, Ohio, is distributing a combination celluloid and cardboard slide rule which quickly reveals the voltage operating characteristics of electric lamps, and affords a simple analysis of the economics of incandescent lighting.

CONTROLS. The Shallcross Control System Co., Milwaukee, Wis., has brought out a new loose-leaf catalog on the various controls for gases and liquids.

PLASTICS. A bulletin entitled "Plastic Products" has been issued by the Plastics Division at Lynn, Mass., of the General Electric Co., containing a brief summary of the company's plastic products and the parts that may be formed therefrom.

PRESSURE PIPE LINES. The Engineering Department of the American Rolling Mill Co., Middletown, Ohio, has recently issued a bulletin under the title "Designing Pipe Lines for Pressure," giving engineering information on that subject.

SHEET METAL MACHINERY. The Fred J. Swaine Mfg. Co., 1300 North Seventh St., St. Louis, Mo., has issued a 48-page bulletin on its line of open-back inclinable presses, power punching presses, and sheet metal tools. Various features of construction are explained with the aid of detailed photographs, such as the Swaine automatic bolt clutch. Each size and type of press is illustrated and a brief list of specifications given.

SPEED REDUCERS. The W. A. Jones Foundry & Machine Co., 4401 Roosevelt Road, Chicago, Ill., has issued bulletin No. 53 on Small Herringbone-Maag Speed Reducers for Small Motor Drives, describing the No. 90-D and 105-D units recently brought out by the company.

STEEL. Darwin & Milner, 1258-64 West Fourth St., Cleveland, Ohio, has issued a booklet entitled "Patent Air-Hardening Cobalt-Chromium Steel Brand—Cobaltcrom PRK 33."

WELDED GEAR BLANKS. A single-page bulletin describing gear blanks made of arc-welded rolled steel has been issued by Lukenweld, Inc., Coatesville, Pa. This short bulletin is preliminary to a more complete engineering bulletin to be published later.

WELDERS. The Thomson-Gibb Electric Welding Co., Lynn, Mass., and Bay City, Mich., has issued a bulletin describing a special 50-ton projection welder designed and built by the company for one of the largest automobile wheel manufacturers.

BUSINESS ORGANIZATION. The Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y., through its Policyholders' Service Bureau, has recently issued Business Organization Bulletin No. 13 on "Functions of an Assistant to the President," dealing with typical functions of this executive in business.

Reference Book Sheet

COMMERCIAL MECHANICAL LAPPING

LAPPING may be roughly defined as precision finishing. Specifically, it is the final stock removing operation by means of which pieces of work are brought to desired size within closer tolerances and with a finer finish than can be obtained by other known mechanical processes.

Types of Machines

Industrial requirements ordinarily demand lapping machines arranged to use three types of lapping mediums. One uses metal laps and loose abrasive grain mixed with a lubricant and is used for gage manufacture. Another uses bonded abrasives for commercial production work. A third and more recent type, so far used for crankshaft lapping exclusively, employs abrasive paper or cloth instead of cast iron or bonded abrasives.

One company classifies lapping machines as vertical and horizontal. The vertical machines are so called because the laps are mounted on vertical spindles and the work is driven in a horizontal plane between the lower and upper laps, both of which are in contact with the work. Since horizontal machines have only been used for crankshaft lapping, only vertical types will be considered.

One vertical type consists fundamentally of a base in which is mounted the mechanism for driving the lower lap and the workholder. A post, also mounted on the base, carries a swinging over-arm to which is attached the upper lap. This does not rotate but is free to float and find its own level when brought in contact with pieces to lap.

The laps are made from a soft, close-grained cast iron. The lower one is mounted on a tubular spindle driven by a hardened steel worm and bronze wormwheel and revolves in a counter-clockwise direction at a speed of approximately 60 r.p.m. The workholder, driving the parts being lapped, rotates in the same direction as the lower lap but at a slightly slower speed.

When arranged for cylindrical pieces there is through this tubular spindle a shaft running in bronze bushings and driven by a train of gears from the spindle. This is called the "break-up shaft." On its upper end is mounted a head with an adjustable slide carrying a driving pin which is eccentric with the spindle an amount suitable to give sufficient eccentricity of the workholder. The amount of eccentricity will depend on the work being lapped.

The workholder has a bushing in its center and is free to turn upon the eccentric driving pin. When the lower lap rotates, the work between the stationary and rotating laps acts as a set of roller bearings carrying the workholder around the eccentric drive pin at a speed approximately one-half that of the rotating lap. The eccentric pin is driven in the same direction as the lower lap but at a different rate, and the combined rotative and eccentric movements cause the work to roll and slide back and forth between the faces of the laps. This is the "break-up."

The other vertical type machine is much larger and heavier and is equipped with bonded abrasive laps instead of cast-iron laps. Also, both the upper and lower laps revolve, in opposite directions and at different speeds.

By means of convenient adjustments, it is possible to regulate the pressure of the upper lap against the work. The machine is also equipped with a pump which supplies a lapping lubricant to the work during the operation. No loose abrasive is used and washing of the parts after lapping is unnecessary. This is primarily a production type. In many instances the rate of production may be increased from two to four times and the finish is nearly as good as that obtained from cast-iron laps.

Types of Workholders

Workholders differ widely, the simplest form consisting of a circular disk perforated with holes near its periphery. These holes are of such size that the work can be laid in them as the workholder rests in position on the machine. Sufficient clearance is provided between the workholder and the pieces so that they may float about freely between the lap surfaces.

When the workholder is arranged for cylindrical pieces which do not have a hole through them, the openings are of the approximate shape of the piece. The axis of the opening is not radial, but tangent to a circle approximately 3 in. in diameter concentric with the center of the workholder.

For lapping cylindrical pieces, such as piston pins, which have a hole through the center, a leg or spider type workholder is used. This consists of an aluminum center plate with hardened steel spindles inserted about its periphery. In the case of the flat or plate workholder for cylindrical pieces, these spindles are not placed radially, but have their axes tangent to a circle about 3 in. in diameter. The pieces fit loosely over the spindles and are held in position by an outer ring provided with hardened steel thrust plates. Four of the spindles are longer than the others and it is to these that the outer ring is locked. Usually each machine is equipped with two workholders so that one is available for reloading.

Preparation

From a production standpoint, lapping is not a stock removal operation. In no case should more than 0.0005 in. material be left for the lapping operation. Lapping is not intended to replace grinding, but further to refine pieces beyond that point of finish and accuracy produced by the grinding operation.

Before lapping, parts always should be ground to close limits for size, parallelism, roundness or flatness, although the ground finish is not so important. All too often upon the addition of a lapping operation the grinding is allowed to be carelessly performed. Unless the part is carefully and accurately ground the lapping operation will not be successful. True it is that the lapping operation will eliminate some of the errors left by grinding, but for best results the grinding should be just as carefully and accurately performed as though lapping were not to follow.

Preparation and Care of Cast-Iron Laps

The real secret of machine lapping is in having the lap surfaces in a true plane. It is essential that they be kept in good condition if satisfactory results are to be obtained. For very precise work, after planing, three laps are hand scraped to a good surface plate and are then worked together on an upright drill press, one lap being fastened to the table of the drill press and another lap resting on it. The surfaces are prepared to come together with a film of abrasive and oil between them. By means of a short-throw crank attached to the drill press spindle, the upper lap is made to move in a circular eccentric path across the lower lap, which motion also causes the upper lap to rotate slowly about its own axis. This combination rotative and eccentric movement of the upper lap reduces the faces of both laps until they match.

To obtain the true planes necessary, the first lap is worked with the second, then the first with the third, the second with the third and the third with the first as in the production of master surface plates. Once the true lapping surface is established, any subsequent dressing may be performed without removing the laps from the machine unless their form has been destroyed.

The laps are made in the form of a heavy ring with the hole in the center greater than half the outside diameter. The thickness is usually 3 in. or 4 in. to prevent any distortion while in use and the outside diameter varies with the size of the machine.

In redressing the laps after service, the frequency of which will depend to a large degree on the accuracy required, the overarm supporting the upper lap is first released and the lap allowed to rest on the lower one with a suitable mixture of abrasive (not coarser than 220) and lubricant between the faces. With the machine in operation the upper lap is moved back and forth by hand, so that half its diameter overhangs the lower lap first on one side and then on the other, using a short bar inserted in a hole provided in the periphery. Frequent inspection with a straight edge, the length of which should be great enough to extend across the full diameter of the lap, will indicate when the surfaces have been corrected. If the laps have a very bad error, it will probably be necessary to remove them from the machine and have them reconditioned as described in connection with the preparation of new laps.

Abstracted from "Commercial Lapping" through the courtesy of the Norton Company, Worcester, Mass.

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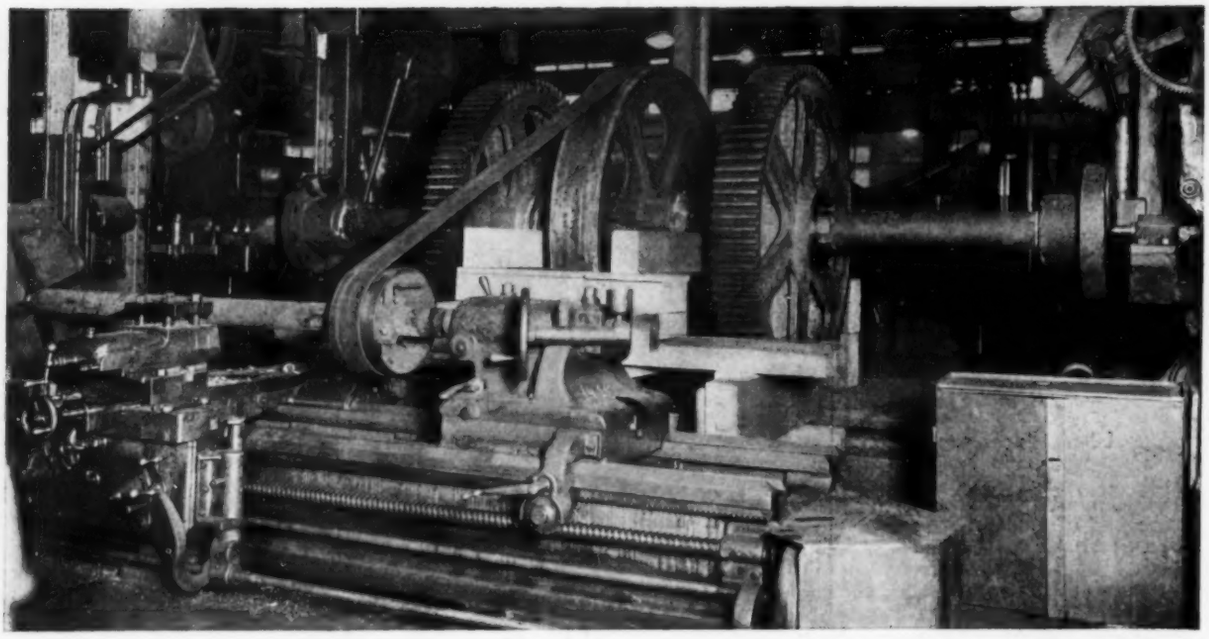
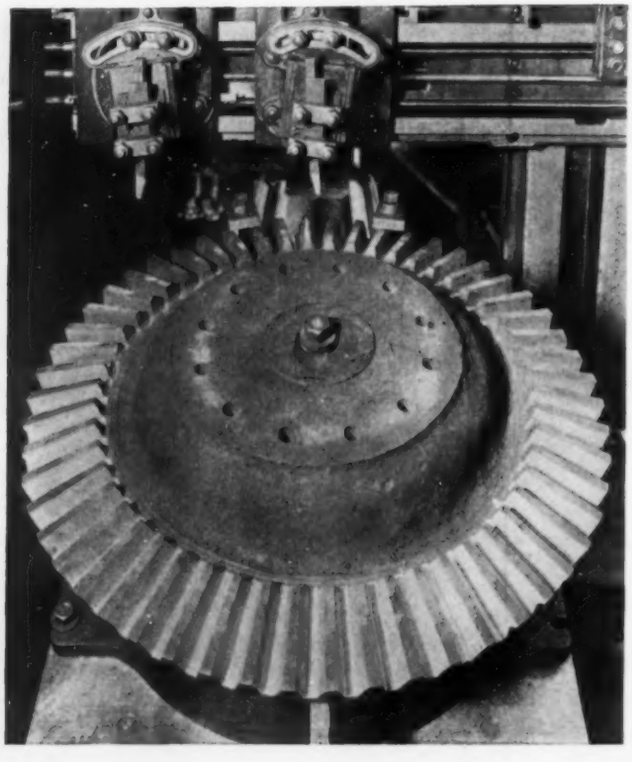


Fig. 1—Using a frame slotter as a lathe

Frame Slotter and Planer on Unusual Jobs

▼

Fig. 2—Cutting bevel gears on a planer



INGENUITY and the ability to improvise machines and methods are of great value in any shop where out-of-the-ordinary jobs must be handled or else shipped to distant points. While the Norfolk & Western shop at Roanoke, Va., has standardized its regular work of maintenance and building, it also handles many emergencies on machinery connected with the road. Two jobs of this kind are shown.

The drive shaft of a large-geared hoisting unit had to have new flange couplings on each end. It was no special trick to put them on but they had to be faced true after being in place. Improvised centers were put on two heads of a big frame slotter, and the heads were moved the right distance apart and the assembled shaft swung in place as in Fig. 1. The shaft was driven by a belt from a pulley mounted in the lathe beside the slotter, and facing tools were mounted in the tool blocks. It was then only necessary to feed the tool heads across the flange with the slotting ram locked against vertical motion. Both flanges were faced at once and the job itself took but little time.

Another occasional job is the making of a large bevel gear as shown in Fig. 2. After a careful study of costs it was decided to make these gears as the necessity arose. A heavy fixture was made that would center the gear blank and also hold it at the proper angle. A simple but effective index was also provided. In machining, the teeth are first roughed out with a hogging cutter and then finished with the two form tools shown, one being used on each side of the tooth. Rigidity is assured by the clamps each side of the tooth being cut.

AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, August 13, 1931

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Industrial Research

The International Management Institute of Geneva makes note of a remarkable report which deals with the research groups of the Association of German Machine Tool Factories of Charlottenburg.

At present there are four groups making up the Association. Group I consists of eight firms in the medium and large scale industry. Three of these have a joint sales association. Group II consists of fourteen machine tool firms of varying size. Group IIa consists of five large scale machine tool firms. Group III is made up of five medium size firms in the machine tool industry.

Characteristically these groups are constituted as follows:

Group I, eight machine tool factories: one radial drill plant employing 400 persons; one grinding machine plant employing 400; one turning engine plant employing 300; one sheet metal machine plant employing 1,400; one horizontal drill plant employing 300; one sales association representing three drilling machine plants employing 300.

Group II, fourteen machine tool firms, some of which are actually competitors brought together to discuss some special subject.

Group IIa, five machine tool plants: one turning engine plant employing 1,000; one sheet metal machine plant 700; one milling machine plant 600; one grinding machine plant 400; one drilling machine plant 600.

Group III, five miscellaneous plants: one turning engine plant 400; one drilling machine plant 500; one sheet metal plant 300; one planing machine plant 400; one milling machine plant 400.

There is no close-knit regionalism, as some elements of the groups are as far distant from another as five hundred miles. In other instances, indicative of regionalistic influences, some of the member plants are almost next-door neighbors.

Research has been centered chiefly on management and administration — purchasing systems, production and operation, propaganda, sales, etc. The management and other sub-groups meet from time to time and even visit plants of the groups for purposes of analytical comparisons. Research is also carried out by correspondence.

Periodic meetings of the management groups have, during the past two years, treated of such topics as the Cleveland Machine Tool Exhibition, Standardization in America, Employees Collaboration, Management, Literature, Treatment of Visitors. Similar topical discussions have been carried out by the purchasing, production and sales groups. In all, about two hundred topics have been discussed during the two year period.

The cooperative exchange of ideas and experiences, both in meetings and by correspondence, has demonstrated that all parties have drawn manifest advantages therefrom, concrete advantages that have been directly reflected in improved production methods and cash savings. One is tempted to draw a moral for American manufacturers.

Not a Release

Many newspapers choose to believe that Secretary Lamont has relegated President Hoover's wage rate policy to the past tense, but reasonable men will not construe that industry is released from the pledge given to President Hoover.

"No one could have done more to maintain wage rates," wrote Secretary Lamont in informing Representative Condon, of Rhode Island, that the President could not intervene in a local textile strike in that state.

When Lamont said in the same letter, "I do not believe it is the duty of the government to interfere in such cases," and added, "neither do

I think such interference could be effective," it was widely interpreted as a retreat by the administration from the ground occupied for nearly two years. But his statement referred only to firms that are now in difficult circumstances. "Some of them," said Secretary Lamont, "are faced with the prospect of closing down altogether and thus creating more unemployment or alternately, seeking temporary wage cuts."

Short hours are tragic enough, as any workman can testify. American industry must and will stand firm.

A Rocky Mountain Council

Economic movements are like the proverbial snowball—give one a good start and some right hearty extra pushes in the right direction, and it becomes virtually self-rolling.

The movement for regional economic councils in the United States is a case in point. First came the New England Council. Gradually it struck its stride; its need was real; it became an outstanding success. The renaissance of New England was assured.

Early in 1929, a group of McGraw-Hill editors visited the Southeastern states. It was only too clear that the industrial leaders of that region could most profitably found a council patterned after New England's. The editors recommended it. The Southeastern Council became an actuality this summer.

The snowball keeps on rolling and growing. Now the Rocky Mountain Council has been formed. It is significant that the stimulus for this latest council came also from McGraw-Hill editors; all most heartily wish the new council every success.

◂◂ CHIPS ▸▸

European troubles seem less menacing . . . Germany resumes bank payments, has a reassuring election . . . England is fortified with our credit . . . President Hoover is given a breathing spell to turn his mind to domestic problems . . . His earnestness in tackling the problems of next winter's unemployment is noteworthy . . . Whether he can duck the dole is another thing . . . American industrialists would do well to revive the time-honored practice of writing to their Representatives in Congress.

Second-quarter earnings offer encouragement . . . totals do not look bad in comparison with first quarter . . . Average savings bank accounts show growth of $12.71 each since January . . . There's gold in this old country yet . . . Up to some of us to keep it all from going to the mail order houses and chain stores.

Peerless Motor Car Company is about to present aluminum-alloy line of cars . . . frames, engines, bodies, axles . . . Sixteen-cylinder line to weigh a thousand pounds less . . . Stinson Aircraft Corporation reports delivery of 979,000 dollars worth of airplanes during first five months of 1931 . . . twenty per cent of all commercial planes delivered in United States during that period.

GOOD OLD JAMES

Intent upon the welfare of American industry, Mayor Walker of New York spoke at a dinner . . . "One important factor necessary in the building of a merchant marine is the patronage of our own ships!" . . . This was July 31.

August 3, Mayor Walker sails on the German S.S. "Bremen."

The Interstate Commerce Commission puts ahead its sessions for rebuttal on blanket freight rate increases . . . Wall Street and the railroads will be relieved to have a decision . . . not forgetting the manufacturers.

Motor car junking proceeds apace . . . 300,000 for the year . . . Ford has ambitions to junk five thousand per day . . . more new business for all the automobile manufacturers.

First to snap out of any depression are consumption products . . . shoes run sixteen per cent ahead of last year . . . wool, forty per cent . . . silk consumption up forty-three per cent in June . . . Though wheat seems to try to break through all lows, it is significant that it constitutes but seven per cent of our total farm production . . . ninety-three per cent of agricultural produce shows better returns . . . ostrich feather tips jump from fifteen to fifty dollars per pound.

PAINT THAT RESISTS RED HEAT

A friend of ours who happened to attend the British Industries Fair reports that he was greatly impressed by an exhibit devoted to silicon ester. He expects that this material will become of considerable importance to industry, partly through its use as a paint when combined with a pigment.

As distinct from paints made from drying oils

and other organic materials, silicon ester paints are said to resist temperatures as high as 1,000 deg. C. (1,832 deg. F.) without injury to the film, which is pure silica, whereas ordinary paints disintegrate at temperatures of 300 deg. F. or lower. Apparently the new paint promises to meet the long felt want for a coating that will stand up on internal combustion engine exhaust manifolds and other metal surfaces subjected to high temperatures. Besides being heat- and fire-resistant, the film is said to resist many acids and alkalies and to be suitable for use on many materials besides metal. Silicon ester may also become a binder for molding materials having high heat resistance and good electrical properties.

"How do you find business?"
"By going after it."

CREDITS AND MORATORIA

"For one of the companies I represent I am in competition with a German sales representative. Under the conditions of Germany's financial condition their methods of negotiation on this deal are interesting.

"The transaction involves about 5,000 dollars. They will accept this order, place the equipment in on a trial basis, give the customer ninety days without any down payment.

"They will extend terms up to ten or twelve months at the option of the purchaser, arranging equal monthly payments, and will charge no interest on the deferred notes.

"I am wondering if this is usual practice."

—JOSEPH F. PFLUM.

We are doing a little wondering ourselves.

Welcome news to many fans and friends . . . "The Houghton Line" is about to be resumed under the editorship of Louis E. Murphy, lifelong associate of Charles E. Carpenter.

THIS WEEK IN *AM*

We read this and we read that about Soviet Russia. If this is favorable, we suspect the author's particular shade of redness or pinkness; if that turns thumbs down, we are all too sure that the author suffers from chronic indigestion. Whatever the article, generalties are almost sure to outnumber particulars.

The leading article in this issue is different. With an engineer's objectivity and intuition, Walter N. Polakov discusses thoroughly one case of management in a metal-working plant. Read "The Gantt Chart in Russia"; decide for yourself whether the Five-Year Plan will succeed or fail.

Are you interested in patents for yourself or your firm? See page 274. Machining duralumin? See page 269. In this issue are to be found the most practical kind of data on nickel plating die castings, gamma ray inspection of welds and castings, finishing the hole in a 30-foot shaft, lapping, and many other subjects of prime interest to executive and operative.

James Goodwin Hall, who flies for the repeal of the Eighteenth Amendment, makes a round trip from New York City to Chicago and return in eight hours and a quarter . . . Even more startling are the achievements of Parker D. Cramer on his airmail survey, Detroit to Copenhagen . . . his plane is Diesel-equipped . . . Sir Hubert Wilkins should have remained true to aircraft . . . his under-ice junket to the North Pole is definitely cancelled for the year . . . Sikorsky tests the largest amphibian airplane successfully . . . seating arrangements for forty-five . . . Zeppelin Company denies reports of large Soviet orders, but proceeds with construction of the LZ-129 . . . larger in gas capacity than the Akron, but shorter and with less power.

H. H. Timken announces an order for 400,000 dollars . . . bearings to equip the new Pennsylvania electric locomotives . . . Negotiations between Remington and Winchester are reaching final stages . . . plan is for Remington to take over certain properties.

• COMING •

For some time past there have been rumors of an unusually effective machinery and equipment replacement policy in the plant of the Ingersoll Milling Machine Co. Here, apparently, were machine tool builders taking their own medicine.

Kenneth H. Condit, editor of *American Machinist,* traveled out to Rockford to see just what there was in these rumors. What he found will be reported this coming week in an exclusive interview with Robert M. Gaylord, president of Ingersoll.

In the same issue, Sam Trimbath, gear engineer, The Willys-Morrow Co., will reveal a new "Testing Device." The cylinder block line for the Marmon Sixteen will be illustrated in detail.

For week after next, we have in preparation an article showing how to produce hot-rolled nickel steel pinions. And Nikola Trbojevich, research engineer, The Timken-Detroit Axle Co., has completed an outstanding presentation of "Some Advanced Worm Hob Designs."

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

OPTIMISM and some actual upturns are reported in machinery and machine tool markets during the year's slowest month. Chicago, Buffalo and Philadelphia report uptrends, Philadelphia's occurring last week, Chicago's now in its second week, and Buffalo's in its second month. Other districts are marking time, although good prospects in the shape of inquiries and leads are cropping up. Used tool demand shares the condition of that for new equipment, and industrial buying is still absent.

NEW YORK contents itself with municipal and government business, announcing a 52-tool subway list, a 10-tool school list, a 3-tool New Haven railroad list, and no decision yet on 19 tools for the Brooklyn Navy Yard. Strangely enough, most inquiries are coming from Connecticut. Cincinnati has a fair number of inquiries, most of them indicating early buying, but actual purchases from dealers and builders remain very low. Chicago's board of education has closed on 23 South Bend lathes and some other tools for school shops, and inquiries there appear active and are increasing. Milwaukee hopes for automotive and electrical business, with inquiries, but few orders. Indianapolis is spotty, even special equipment going poorly. Garages and aviation fields are buying a little.

DETROIT calls August a poor year's dullest month, still awaiting automotive orders in the next 60 days. Contract shops there are already at work. Buffalo, selling tools to schools and smaller industries with nibbles from larger ones, hopes its two-month slight improvement will continue indefinitely. New England is relieved that July is over, and looks for business from last month's inquiries. Philadelphia had some reports showing July better than June, though dealers have been fooled so often they hesitate to take the upturn seriously.

NEW YORK

Municipal and government prospects continue to interest dealers during the year's quietest month. Late last week, the Board of Transportation list of tools for the 207th St. subway shops was finally released; it includes about 44 machine tools and 8 woodworking tools. Also, 10 or 12 tools were inquired for by the Schenectady school board for the Mount Pleasant high school. Navy inquiries continue, although the 17 engine lathes and two subsequent turret lathes for Brooklyn Navy Yard have not yet been awarded. The N.Y.,N.H.& H. is inquiring for a lathe, a sensitive drill, and a power brake for the Van Nest shops, probably part of the list withdrawn several months ago. Most inquiries are now being received from Connecticut.

CINCINNATI

The mercury in the sales-thermometer is low, the tendency of demand being to drop in proportion to the rise in atmospheric temperature. Business booked by manufacturers and selling agents is small and without feature, buyers in the main being miscellaneous users. A fair number of inquiries were received, some indicating early buying.

CHICAGO

Improvement noted last week is reported as maintained, inquiries showing a slight increase and some sales being made. The tendency of new inquiry is said to be toward quick closing, as contrasted with former exasperating delay. This is interpreted as an indication that necessity is back of the inquiries. The Chicago Board of Education finally has closed on most of the list for the Austin High School, including 23 lathes to be supplied by the South Bend Lathe Works. Buying against the small list for the Jackson, Jr. High School is expected to follow shortly.

MILWAUKEE

Outside of the undertone of optimism that business will show a healthy trend within thirty to sixty days, industry is marking time. Manufacturers and dealers report occasional small orders from scattered sources. Inquiries, while not plentiful, are coming from sources to place business this fall. The most hopeful source continues to be the automotive field, with electrical concerns next.

INDIANAPOLIS

Business is decidedly spotted. The total volume being done is low, and there are few present indications of any definite improvement. During the last few weeks the demand for contractors' equipment and special machinery for the crushed stone and sand and gravel industries declined. Demand from the automobile industry is rather pitiful insofar as the local factories are concerned. Some demand is received for small tools for garages and aviation fields.

DETROIT

August is apparently the dullest month of an exceedingly poor year in this area. Automobile and associated industries are still living on hopes. This means of course that machinery and tool dealers are at a standstill. Few orders have been obtained this month, and there is little likelihood that the last half of the month will be better.

For several weeks the trade has expressed unusual optimism over prospects for September and October. Dealers seem convinced that plans of the automobile manufacturers for bringing out new and radically different models will necessitate the purchase of a large amount of equipment. Already contract jobbing shops are beginning to get work from the automobile producers. Some larger shops have increased operations within the last ten days; others expect to do so within the month.

BUFFALO

There have been two months of slightly improved selling conditions in the machine tool trade without a setback of any kind. This is the first time in more than a year and a half in which the rise, though slight, has been progressive for so long. Dealers hope that it will just continue.

Right now there are many school equipment jobs taking various standard types of machines. There are still some sales to smaller shops, and inquiries are beginning to come in from some of the larger industries.

NEW ENGLAND

Trials and tribulations experienced during July are over, and the trade is mighty glad of it. Except in scattered instances the month gave no encouragement in actual orders, but developed plenty of optimistic tendencies. Machine tool builders and dealers as a whole expected no improvement and were not diappointed.

Orders for the week were for one or two units, with not a too plentiful supply of these. The trade is waiting for placement of some of the new business figured in July.

PHILADELPHIA

Slight improvement was noted last week. Some reports showed July somewhat better than June, and while those who reported this condition did not consider it an indication of marked improvement the number and tone of inquiries was bettered.

Two large producers reported quotations, but the time for closing appears uncertain. Mechanical departments of potential customers have been recommending purchases, but boards of directors and other agencies which hold the power of purchase are slow to act.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

The week's happenings furnished fresh proof of the fundamental futility of attempting to change basic conditions. An exchange of views is about the only definite result that can be attributed to the bankers' conference held in Berlin. If we had a derrick strong enough to pick up North and South America and put Europe and Asia in their places, it might be mechanically possible to exchange the present contents of the Western Hemisphere for the land and the sea that the map makers now put east of the meridian of Greenwich.

But pondered for just a moment the idea becomes manifestly absurd, and it requires only another moment's reflection to appreciate the impossibility of shifting much real property from the west to the east, or vice versa. The truth is that nature has made real property irremovable. It may be destroyed, but its locale cannot be greatly changed.

What we call wealth consists chiefly of promises to pay the debts due by one man to another. If the axiomatic quality of this statement be admitted, it is plain that any settlement of the reparation indebtedness must represent a meeting of minds to which the contracting powers have assented and will adhere.

Difficulty of Agreement

George Washington pointed out the difficulty of obtaining such an agreement many years ago. Since then there has been some improvement in the ethics of international intercourse, but it is still chiefly governed by considerations of what is deemed self interest. Therefore, the reparation debts will probably continue to vex the world's peace of mind until they are paid, revised, or forgiven. Meantime, it is almost certain that we shall have periodical flare-ups over the debt matter, and that they will continue until the people have wearied of talking about them, or the generation in whose behalf they were incurred has passed on.

This frank statement is made because the time seems to have come when people are bored by a discussion of these reparation debts, and the banks and bankers who have to deal with them are about the only group that exhibits any acute interest in their ultimate disposition.

Meantime, it is gratifying to report that business in America is picking up. This report will be challenged by some, and it is not susceptible of circumstantial proof, as statistics are too elusive. It is, however, certain that more people are at work, and that the reduced cost of living has enabled a great many to buy more than they could obtain for the same money a year ago. Hence, they feel more cheerful, and constructive enterprise is commencing to make itself apparent all over the country. The fact that commodity prices are low, and in many cases lower than they have ever been before, is attracting wide attention.

There are many who insist that this is due to the recent advance in the price of the silver in which those who live in the Orient are now demanding payment for the goods they sell. This seems a paradoxical statement, but the concurrent advance in both silver and gold that was reported last week appears to sustain it. It is true that advancing markets quicken business in the Orient as elsewhere, and that the recent rise in the price of silver has had a stimulating effect upon business in Mexico, South America and Asia. For this reason the close observer will be wise to keep his eye upon the price of silver, as a further advance in it would undoubtedly increase the business between the Occident and the Orient.

Work for Winter

Probably the most important item in the domestic news of the week has been the earnestness with which the President is trying to provide work for the unemployed during the winter of 1931-32. How far he will be able to reconcile an increase of public employment with a reduction in the Government payroll remains to be seen, but there are some members of the House and Senate who may be willing to help him out. There seems to be what may be called an unadmitted increase of activity in the steel industry, if one may judge by the firmer attitude on prices, and the demand for copper at present prices is larger than had been expected.

The action of Oklahoma in shutting down the production of some of its oil wells and the curtailment in coal production that has been ordered in other states may or may not be helpful. That profits are increased by reducing production is a proposition that used to be regarded as fallacious, but we are being called upon to face many novel dicta, and it may be that we will soon hear that extravagance rather than economy is the road to wealth.

Present conditions do not sustain this allegation, but with wheat at the lowest prices on record, and many other important commodities selling for less than it costs to harvest them, we must be miserable unless we are able to persuade ourselves that whatever is is best.

The comparative cheerfulness of the country facing such an emergency is remarkable, and is explicable only upon the theory that some of our economic inferences are in error.

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THE BUSINESS WEEK

August 12, 1931

Earnings reports for the second quarter are not discouraging . . . European difficulties seem less menacing . . . Germany is calm; London is fortified with our credit . . . These are the two cheerful things to be said of the most sluggish week of a sluggish summer . . . The pulse of August, always listless, drops to a new low rhythm, as recorded by our index. . . . Automobile plants close down; building is curtailed sharply, foreshadowing dull days for steel makers . . . Cotton, wheat, and copper prices move slowly downward in lackadaisical trading . . . Efforts to dispose of surplus stores abroad are commended by statesmen and economists, criticised by some sectional politicians . . . Security markets were unexciting . . . Declines in car loadings and bank debits also reflect the summer inertia . . . Though currency circulation has contracted somewhat, the level remains excessively high . . . The public is hoarding cash . . . The promising expansion of bank loans has been stunted . . . In spite of ample reserves, credit expansion is restricted that liquidity may remain high . . . The open market operations of the Federal Reserve continue to meet the resistance of member banks . . . Mexico goes on a silver standard but calls it by another name . . . The result, to American investors, is the same . . . Meanwhile, Washington begins relief preparations for a gloomy winter ahead and a state government resorts to a martial law to raise the price of oil . . . It may work just as well as most government price boosting schemes.

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Material Trends and Prices . . . .

Not enough orders were forthcoming from the various avenues of steel demand, other than construction, to keep the mill-operating rate at 32 per cent of capacity. It has dropped back to 30 per cent in two weeks' time. In the non-ferrous group, lead appears to be in fair demand, compared with most of the others. Fabricated brass and copper are down ½c. and ¼c., respectively.

(All prices as of Aug. 7, 1931)

IRON AND STEEL

	Current	Mo. Ago	Yr. Ago
Pig Iron—			
Birmingham, No. 2, Fdry., per gross ton	$12.00	$12.00	$14.00
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	16.00
Heavy Melting Steel Scrap—			
Pittsburgh consuming point, No. 1, per gross ton	10.50	10.00	15.25
Furnace Coke—Connellsville, per net ton	2.40	2.40	2.50
Foundry Coke—Connellsville, per net ton	3.25	3.50	3.50
Steel Shapes—Pittsburgh, base, per 100 lb	1.60	1.65	1.60@1.65

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Iron Machinery Castings—Cost in cents per lb. of 100 fly-wheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

Chicago	4.62½	Cleveland	4.50
New York	4.75	Cincinnati	4.40
Detroit	4.00		

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Steel Sheets—Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10*	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

* Light plates.

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Seamless Steel Tubing—Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall	Outside Dia. in Inches						
	½	¾	¾	⅞	1	1½	1¾
Inches B.w.g.	Price per Foot						
.035 20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc.—Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel—Hot-rolled bars, base, Pitts., cents per lb:

Chromium, 15%, carbon 0.12% and under	19.00
Chromium, 15 to 18%, carbon 0.12% and under	20.50
Chromium, 18 to 23%, carbon 0.12% and under	23.00
Chromium, 23 to 30%, carbon 0.12% and under	28.00

Bolts and Nuts—Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots ..... 73@10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:

Aluminum ingots, 99%, N. Y.	23.30
Copper, electrolytic, Conn	7.50
Copper wire, base, Chicago and Cleveland	10.12½
Copper wire, base, N. Y.	10.00
Lead, pigs, E. St. Louis	4.22½
Tin, Straits, pigs, spot, N. Y.	24.50
Zinc, slabs, E. St. Louis	3.85

Prices following are in cents per lb., base, N. Y., Chi. and Cleve:

Brass rods, high	13.62½
Brass sheets, high	15.37½
Brass tubing, high	20.25
Copper, drawn round	16.12½
Copper sheets	17.62½
Copper tubing	20.12½

Prices following are in cents per lb., del. from N. Y. warehouse:

Babbitt, anti-friction, general service	28.50
Babbitt, com'l, intermediate grade	34.25
Babbitt, genuine, highest grade	44.00
Solder, bar	19.12½

Prices following are in cents per lb., base, Huntington, W. Va:

Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals—Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	3.00	4.25	4.00@4.25
Light brass	2.50	3.25	3.25@3.75
No. 1 rod-brass turnings	3.50	4.50	4.00@4.50
Heavy copper	5.75	5.75	6.25@6.75
Light copper	4.75	5.00	5.50@6.00

SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide mineral, cloth, 6-in. dia., No. 1, less than 200, per 100	$4.36	$4.59	$4.59
Belting, leather, heavy, discount	30@10%	40%	40%
Belting, rubber, trans., 1st grade, discount	60–10–10%	60–10%	60%

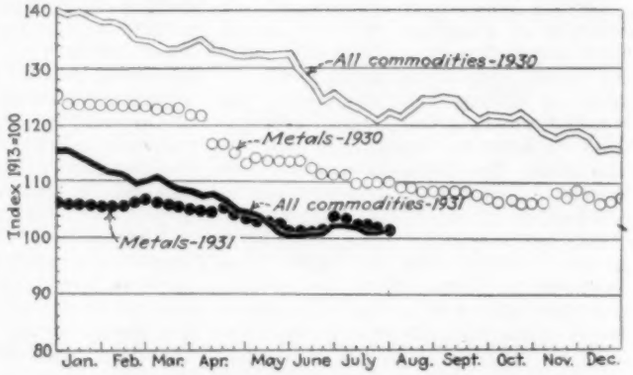
Lumber—Per M ft., b.m., 16 ft. lengths, del., N. Y:

Crating—Southern pine:

1x4-in. ..... $27.00 1x6-in. $26.00

Skids—Spruce:

2x4-in. .. $37.00 3x3-in. .. $46.00 4x6-in. .. $48.00 6x6-in. .. $52.50



Price Indexes Week by Week

(6 Metals and 74 Commodities—Figures from The Annalist.)

NEWS

Steel Treaters Announce Papers For Metal Congress Sessions

Fifty-five technical papers appear on the program which the American Society for Steel Treating has prepared for its sessions of the forthcoming National Metal Congress in Boston, the week of Sept. 21. This is the largest number of papers ever on an American Society for Steel Treating Program, according to RAY T. BAYLESS, secretary of the Publication Committee. National Metal Congress programs of the A.I.M.E., the A.S.M.E., and the American Welding Society will also be larger than usual.

The National Metal Exposition will be located this year in the Commonwealth Pier, near the Hotel Statler, headquarters of the A.S.S.T., the A.I.M.E., and the A.S.M.E., and the Hotel Copley Plaza, chosen by the A.W.S. as headquarters. More than 200 firms have reserved space in the Exposition, which will cover 60,000 sq.ft. this year, almost twice as large as the 1930 show; 75,000 metal men are expected to view them during the course of the week.

The A.S.S.T. technical program of the Congress lists the following papers:

"Solubility of Oxygen in Solid Iron"—*By N. A. Ziegler, Westinghouse Electric & Mfg. Co.*

"Hardness of Chromium as Determined by the Vickers-Brinel, Bierbaum, and Mohs Methods"—*By Richard Schneidewind, University of Michigan.*

"Dendrites in Nickel Steel"—*By Albert Sauveur, Harvard University, and E. L. Reed, American Sheet & Tin Plate Co.*

"The Characteristics of Deformation of Steel Under Constant Load at Elevated Temperatures"—*By G. R. Brophy, General Electric Co.*

"Some New Aspects of the Iron-Carbon Diagram"—*By H. A. Schwartz, National Malleable & Steel Castings Co.*

"Correlation of the Crystal Structures and Hardnesses of Nitrided Cases"—*By O. E. Harder and G. B. Todd, Battelle Memorial Institute.*

"The Resistance to Wear of Carbon Steels"—*By S. J. Rosenberg, U. S. Bureau of Standards.*

"Endurance Properties of Some Well-Known Steels in Steam"—*By T. S. Fuller, General Electric Co.*

"Corrosion Resistant Steels"—*By R. L. Duff, Standard Oil Development Co.*

"Surface Energy of Iron Carbide"—*By Yap, Chu-Phay.*

"Comparison of Sheet and Strip Steels for Difficult Stampings"—*By Edward S. Lawrence, Duraloy Co.*

"Nature of Abnormal Grain Growth in High Speed Steel"—*By G. R. Brophy and R. H. Harrington, General Electric Co.*

"Aging in Low-Carbon Steels"—*By A. Allan Bates, Case School of Applied Science.*

"Cemented Tantalum Carbide"—*By Floyd C. Kelley, General Electric Co.*

"Nondeforming Alpha-Delta Carburizing Steel"—*By A. B. Kinzel, Union Carbide and Carbon Research Labs.*

"Behavior of Some Irons and Steels Under Impact at Low Temperatures"—*By Robert Sergeson, Republic Steel Corporation.*

"Influence of Grain Size on the Properties and Corrosion Resistance of the 18-8 Iron-Chromium-Nickel Alloy for Elevated Temperature Service"—*By H. D. Newell, Babcock & Wilcox Tube Co.*

"Plastic Drawing of Sheet Steel Into Shapes"—*By E. V. Crane, E. W. Bliss Co.*

"Short-Time Nitriding"—*By J. J. Egan, Union Carbide and Carbon Research.*

"Scaling of Steel at Elevated Temperatures by Reaction with Gases and the Properties of the Resulting Oxides"—*By D. W. Murphy and Wm. P. Wood, University of Michigan, and W. E. Jominy, A. O. Smith Corporation.*

"Thin Strip Steel for Deep Drawing"—*By H. T. Morton and I. A. Rummler, Hoover Steel Ball Co.*

"Some Physical Properties of High Speed Steel"—*By J. V. Emmons, Cleveland Twist Drill Co.*

"Thermomagnetic Phenomena in Steel"—*By R. L. Sanford, U. S. Bureau of Standards.*

"The Cold Treatment of Certain Alloy Steels"—*By G. V. Luerssen and O. V. Greene, Carpenter Steel Co.*

"Characteristics of Alloyed Cast Iron"—*By F. W. Shipley, Caterpillar Tractor Co.*

"Impact Characteristics of Steel Rails at Low Temperatures"—*By J. F. Cunningham and James Gilchrist, University of Manitoba.*

"Manufacture, Properties and Uses of 18-8 Chromium-Nickel-Steel Wire"—*By W. H. Wills and J. K. Findley, Ludlum Steel Co.*

"Precious Metal Alloys"—*By R. C. Brumfield, Cooper Union.*

"Identification of Inclusions"—*By Leland E. Grant, Chicago, Milwaukee, St. Paul and Pacific R.R.*

"Effect of Heat Treatment Upon Ferrite Banding of Steel"—*By W. E. Harvey and Bradley Stoughton, Lehigh University.*

"Effect of Normalizing Upon the Grain Structure and Physical Properties of Automobile Sheet Steel"—*By Wm. F. McGarrity, Youngstown Sheet & Tube Co., and H. V. Anderson, Lehigh University.*

"Influence of Special Elements on the Carbon Content of the Iron-Carbon Eutectoid"—*By E. L. Reed, American Sheet & Tin Plate Co.*

"Further Studies on Chromium-Nickel-Iron and Related Alloys"—*By V. N. Krivobok, E. L. Beardman, H. J. Hand, T. O. A. Holm, A. Reggiori and H. S. Rose, Carnegie Institute of Technology.*

"Inspection of Welds with Gamma Rays"—*By Gilbert E. Doan, Lehigh University.*

"Alloys of Iron, Manganese and Carbon"—*By F. M. Walters, Carnegie Institute of Technology.*

"The Role of Energizers in Carburizing Compounds"—*By George M. Enos, University of Cincinnati.*

"Tool Steel from the Consumers' Standpoint"—*By H. G. Keshian, Chase Companies, Inc.*

"Melting of Tool and Other High Grade Steels in the Basic Electric Furnace"—*By J. P. Gill and R. E. Trembour, Vanadium Alloys Steel Co.*

"Ghost Lines in Forgings"—*By J. F. Harper and H. J. Stein, Allis-Chalmers Mfg.*

"Age Hardening Phenomena in Typical Fusion Weld Metal"—*By F. R. Hensel and E. J. Larsen, Westinghouse.*

"Open Hearth Process"—*By C. H. Herty, Jr., U. S. Bureau of Mines, Pittsburgh.*

"Aqueous Solutions of Ethylene Glycol Glycerine and Sodium Silicate as Quenching Media"—*By T. E. Hamill, U. S. Bureau of Standards.*

"Melting of Crucible Tool Steel"—*By Owen K. Parmiter, Firth-Sterling Steel Co.*

"Lubricants Used in Deep Drawing of Sheet Steel"—*By Maurice Keswick, Pennsylvania Lubricating Co.*

"Data on Steel Made Without Manganese"—*By Captain S. B. Ritchie, Watertown Arsenal.*

"Some Effects of the Amount and Rate of Deformation on a Low Carbon Strip Steel"—*By Joseph Winlock and A. E. Lavergne, Edw. G. Budd Mfg. Co.*

"Making of Acid Electric Steel for Castings"—*By George Batty, Steel Castings Development Bureau.*

"Ingots, Ingot Molds and Castings"—*By G. A. Dornin.*

"Thermomagnetic Investigations of Tempering of Quenched 0.75 Per Cent Carbon Steel"—*By C. A. Ellinger, U. S. Bureau of Standards.*

"Division of the Iron-Vanadium-Oxygen System Into Some of Its Constituent Binary and Ternary Systems"—*By C. H. Mathewson, E. Spire and C. H. Samans, Yale University.*

"Magnetic and Mechanical Hardness of Dispersion Hardened Iron Alloys"—*By K. S. Seljesater and B. A. Rogers, Western Electric Co.*

"Development of Italian Industry Making Special Steels and Irons"—*By Federico Giolitti, Torino, Italy.*

"Photomicrographs of Steels with One Per Cent Carbon Arranged in Graded Series for Use as Standard"—*By Haakon Styri and H. O. Walp, S K F Research Lab.*

"The Evaluation of the Drawing Quality of Extra Deep Drawing Sheets"—*By Thomas Dockray, Eastern Rolling Mill.*

July Machinery Dividends Total $7,345,360

Dividends paid by manufacturers of machinery in July amounted to $7,345,360, according to the Standard Statistics Co., New York. Total cash dividend payments made by domestic corporations in July were $516,095,367.

Dry ice box developed by the Boeing Airplane Co. to store heat-treated dural rivets for a week or more. Formerly, rivets had to be heat-treated every half hour

VDI Honors Calvin W. Rice

Calvin W. Rice, secretary of the A.S.M.E., received an honorary award at the recent seventy-fifth anniversary meeting of the Verein deutscher Ingenieure, consisting of a silver plaque especially struck to commemorate the founding of the V.D.I. at Alexisbad in 1856. The citation which accompanied the plaque read: "At the annual meeting in Cologne, commemorating its 75th Anniversary, the Verein deutscher Ingenieure has awarded to Calvin W. Rice, honorary doctor of engineering, its V.D.I. Medal, in grateful appreciation of his services to technical-scientific achievement, particularly in promoting the mutual international interests of the engineers of the entire world."

"Houghton Line" To Be Revived

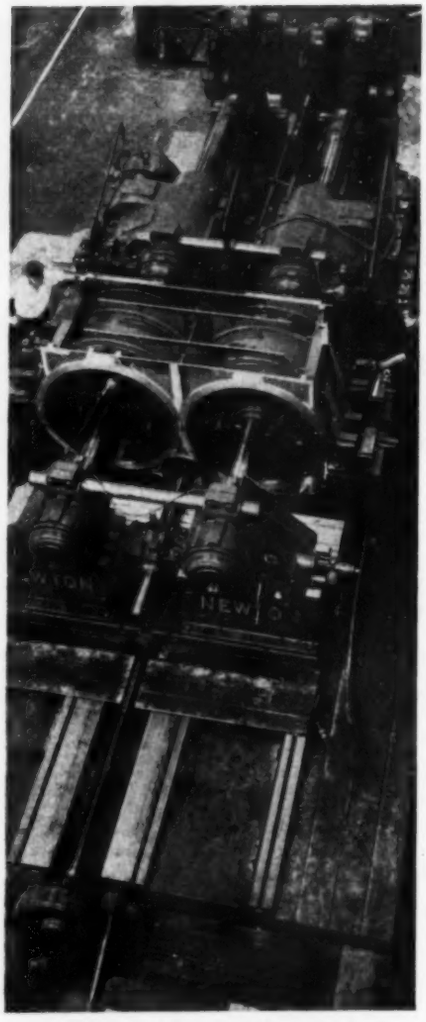
The "Houghton Line," aggressive little one-man magazine, edited, published and circulated by CHARLES E. CARPENTER, president of E. F. Houghton & Co., who died in 1929, and discontinued at that time, will be reissued beginning in September, under the editorship of LOUIS E. MURPHY, now president of the Houghton company. The magazine formerly had a circulation of 250,000.

Kearney & Trecker Adds Two Dealers

The Kearney & Trecker Corporation, Milwaukee, Wis., announces that there will now be associated with the direct factory branches, in the sale of K. & T. products, the Marshall & Huschart Machinery Co. in Chicago and the Motch & Merryweather Machinery Co. in Cleveland and Detroit. Direct factory branches of Kearney & Trecker in these cities remain in the same locations as heretofore. In making the announcement, E. J. KEARNEY said: "We believe this to be something new in machine tool marketing. This move, together with the announcement of our new line of machines, bears evidence to our belief that there will be increased buying of the more advanced machine tools in the not distant future."

Patent Office To Move Soon

Improved service in the issuance of patents will be provided before the close of the present year, when the Patent Office moves into the entire north third floor of the new Commerce Building. This wing, facing Pennsylvania Avenue and nearest to the Treasury and White House, is considered the most desirable office location in the entire Capital. Facilities for inventors and research workers include a vast search room, with a ceiling two stories high, and a correspondingly large and well lighted scientific library. About 10,000,000 copies of patents already granted are kept in stock for sale, and the office sells about 3,000,000 copies a year at 10 cents a copy, making the Patent Office the largest 10-cent store in the world disposing of only one class of goods. The Patent Office was organized in 1790 when the first patent was taken out by one Samuel Hopkins, July 31, "for making pot or pearl ashes," and the second by Joseph Stacey Sampson, Aug. 6, "for the manufacture of candles." Before the outbreak of the Civil War more than 30,000 patents had been granted, and the war so far stimulated inventive genius that by 1870 the number had risen to 40,000. The Patent Office now issues more than 40,000 patents annually.



A $75,000 3-bar boring mill, among the 37 special machine tools installed by Westinghouse to handle the $9,000,000 Pennsylvania order. It will bore twin stator frames and face lateral surfaces simultaneously

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AEC Submits Program For Employment

A program for mobilizing engineers throughout the country in the fight on unemployment has been submitted by American Engineering Council to its member societies. Much emphasis is placed upon the opportunity that engineers have to carry through sound measures for providing and maintaining employment. Alternate plans are suggested for the use of engineers, working through local units. Drafted by a committee of which F. J. CHESTERMAN, Pennsylvania Bell vice-president is chairman, the report has been approved by Council's executive committee and will be made public in the near future.

Railroad Incomes Fall Less Rapidly

Reports by 171 Class 1 railroads to the Bureau of Railway Economics show that, while the net operating income of the carriers for the first six months of this year declined substantially from the total for the same period last year, the downward movement was decelerated in June. While the decrease in income for the half year was 36.8 per cent, the decrease for June, compared with June, 1930, was 27.5 per cent. In this comparison, allowance is to be made also for the fact that earnings last year were at a low level.

Net operating income of the railroads for the six months was $238,550,000, against $377,379,000 in the same period last year, a decrease of 36.8 per cent. Gross revenue was $2,187,437,000, a decrease of 18.8 per cent, and operating expenses were $1,716,774,000, a decrease of 17.2 per cent. Taxes paid totaled $164,738,000, a decrease of 8.6 per cent.

For June, net operating income totaled $50,162,000, against $69,162,000 in June, 1930, a decrease of 27.5 per cent. Gross revenue for the month, was $369,810,000, a decrease of 16.9 per cent. Operating expenses were $280,-145,000, a decrease of 16.3 per cent.

Gas Equipment Makers To Meet Next Month

Members of the Manufacturers' Section, American Gas Association, will meet in annual session, Sept. 17-18, in the Book-Cadillac Hotel, Detroit, Mich. Prominent representatives of the gas industry will appear on the program, according to the announcement. Apart from the general meeting, which will occupy the opening day, there will be separate meetings of the gas range, water-heater and space-heater groups. It is expected that about 500 manufacturers of gas appliances and equipment will be on hand for this session.

No Immediate Business Revival Expected by French Industry

BY OUR PARIS CORRESPONDENT

Whatever stability will ultimately be brought about to allay the chaos of the European crisis of today, as reflected in France more strongly than elsewhere because of her peculiar war debt situation—whether the problem be thus solved or remains unsolved—it is apparent that no immediate business revival is looked for.

There are grave doubts in France as to whether the "Hoover Plan," as it is rather baldly referred to here, for bringing about Europe's resurrection is at all likely to materialize within the prescribed year. If France succeeds in side-tracking German deliveries in kind on reparations account from the agreement, with existing contracts with Germany remaining in force, she will still be obliged to accept them and, *en principe*, pay for them in cash. These deliveries already on contract are said to amount to twenty million dollars between July 1, 1931, and June 30, 1932.

The French point of view is that these deliveries in kind, largely dealing with metallurgical derivatives, should be payable only out of future annuities paid by Germany when the latter again begin payments.

Europe's tariff imbroglio is far from being clarified by the general acceptance of President Hoover's project. Great Britain is on record as having already asked for a reduction of tariffs of certain countries in compensation for maintaining her policy of free trade. France has already received such a proposition, which, so far as transformed or fabricated metallurgical products goes, is not likely to be granted off-hand in spite of the 7 billion francs of French exports annually sold to Great Britain.

The following tabulated items are suggestive of the importance of these interchanges in several lines. Great Britain imported from France, in metric tons:

	1928	1929	1930
Prime movers	6,140	5,228	5,550
Machinery	4,393	3,316	2,844
Tools, etc	23,446	24,387	23,145
Automobile bodies	7,595	5,469	4,165

France imported from Great Britain, in metric tons:

Prime movers	17,735	23,438	23,324
Machinery	2,714	3,529	3,987
Tools, etc	4,325	5,317	6,881
Automobile bodies	940	923	1,386

The figures shown are French Customs statistics.

The trade in second-hand machinery and tools is growing, affecting the trade in new elements in just that proportion as price may be a factor. With the apparently large volume of second-hand items available, this may be taken as an indication that such have been thrust upon the market from having been replaced by new equipment. In any case they do not represent competitive goods in the usual sense.

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Under a Pelton water wheel, Salt Springs power house of the Pacific Gas & Electric Co. on the Mokelumne River, Calif.

Developments in French foreign trade, both coming and going, show that in spite of the increasing national manufacture of typewriters, sewing machines, cash registers, etc., the flow is almost wholly inward. With gas and electric meters, speedometers and cutlery (including razor blades) the reverse is the case. The situation emphasizes that the present, if not the future, of French machine-made metal goods lies in minor lines rather than in goods of big bulk or value.

The present situation of the French automobile trade is another manifestation of this. That the potential interior market for motor vehicles exists still there is little doubt. Saturation has by no means been reached. This may spur activity in an industry that is exceedingly dull. More than two hundred thousand motor cars of all classes on French roads are more than nine years old; this is ten per cent of the total registration. Lower priced, more efficient, higher powered and bigger popular cars, though possibly less speedy, may indeed find a waiting market, say a two or three year output for a couple of modern, model plants.

A view of the French locomotive and rolling-stock industry suggests that while depression has affected world exports of all countries in these lines, notably that of France, Germany has nearly doubled its export of locomotives during the past two years. Wages in this industry have increase 8 per cent in France during the past year but falling prices for raw materials have in a way given compensation.

Wages have been upheld generally in the metallurgical and allied industries, as compared with reductions in Great Britain, Belgium and Germany. The price index on "minerals and metals," as of the last weeks in June, shows a rise of 23 points, to 408, an indication, coupled with the sustained wage scale, that metal manufacturers are not yet due for price reduction. Food prices remain stationary, which is considered as having helped to peg wages for the time being at least.

Imports for the first five months of this year fell off 4,166,396,000 francs in value for "materials necessary for industry," and "manufactured objects" 767,966,000 francs. Exports showed a deficit of 1,267,911,000 francs and 3,426,353,000 francs, respectively. Total imports from Germany decreased nearly half a billion francs; from the United States scarcely less; the figure for Great Britain was a decrease of slightly more than half a billion francs. Germany, the United States and Great Britain sold most to France, in the order named.

Exports were greatest to Great Britain but fell virtually 800 million francs; to the United States the deficit was less than half a billion, while to Germany the figure exceeded half a billion francs. In tonnage, "raw materials for industry" imports fell 11 per cent and exports of manufactured articles 22 per cent.

A.S.M.E. Forms Committee On Machine Design

A Committee on Machine Design has been appointed by F. C. SPENCER, chairman of the Machine Shop Practice Division, A.S.M.E. This committee will arrange for papers on machine design to be presented at meetings of the Society and will, in general, coordinate the activities of members interested in this phase of engineering and manufacturing. Those appointed are: FRANK L. EIDMANN (chairman), professor of Mechanical Engineering, Columbia University; JOSEPH B. ARMITAGE, chief engineer, Kearney & Trecker Corp.; G. H. ASHMAN, engineer, General Electric Co.; GEORGE F. COSGROVE, president, Cosgrove Technical Service; GEORGE F. NORDENHOLT, associate editor, *Product Engineering;* FREDERICK FRANZ, consulting engineer, and ALBERT PALMER, assistant to general manager, Crompton & Knowles Loom Works.

Cincinnati Milling Opens Sales Offices

The Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., Cincinnati, Ohio, which have been represented in the Detroit, Cleveland and Cincinnati territories by the Motch & Merryweather Machinery Co., and in the Chicago territory by the Marshall & Huschart Machinery Co., announce that they have established offices in these territories for direct selling through their own engineers. In other territories, there will be continued the present method of selling by direct factory representatives working with machine tool dealers.

Industrial Profits Show Expected Decline

Aggregate net profits after all charges, but before dividends, of 325 industrial and merchandising corporations whose reports for the past six months have been tabulated by the National City Bank of New York, amounted to approximately $353,000,000, as compared with $639,000,000 in the first half of 1930, representing a decline of 45 per cent. Compared with the record year 1929, the decline was 62 per cent. The tabulation shows, in addition to the comparative profits in thousands of dollars, and the percentage change classified by major industrial groups, the "net worth" or capital stock and surplus account as given on the balance sheets at the beginning of the past two years, together with the percentage return calculated at an annual rate without allowance for seasonal variation. In the first half of 1929 the profits return was at the annual rate of 14.8 per cent on net worth, in 1930 at 10 per cent, and this year at 5.5 per cent. Separate figures for quarterly earnings of approximately three-fourths of the companies, show that the decline as compared with the corresponding period of 1930 was considerably less in the second quarter than in the first. Net profits for machinery manufacturing companies are given as $5,026,000 for the first half of 1931, as compared with $15,870,000 for the first half of 1930, a percentage decline of 68.3. Net worth Jan. 1, 1931 is given as $253,137,000, as compared with $256,678,000, a decline of 1.4, while the annual rate of return in per cent was 12.4 for 1930 and 4.0 for 1931.

BUSINESS ITEMS

The Leavitt Machine Co., Orange, Mass., has acquired the Swendeman Co., Boston, Mass., manufacturer of automatic oil and water separators, and drains for compressed air systems. JOSEPH E. SWENDEMAN will become associated with Leavitt, which will move all machinery to Orange.

The Despatch Oven Co., 622 Ninth St., S.E., Minneapolis, Minn., has recently appointed the following sales representatives: Jones & Manter Corp., 120 High St., Boston, Mass., district sales representative in New England territory, except western Connecticut; F. C. BUTMAN, re-appointed district manager of the Western New York territory.

Negotiations between the Remington Arms Co., and the Winchester Repeating Arms Co., whereby the former would acquire important properties of the latter, are believed to have reached their final stage, decision now resting with Winchester 7½ per cent bondholders. Reports of purchase of Winchester by Remington on July 22 were subsequently denied. Consolidation of Remington and Winchester would result in a $60,000,000 concern.

The Stedman's Foundry & Machine Works, Aurora, Ind., has entered the swing hammer mill field with a complete line of swing and ring hammer crushers, grinders, pulverizers and shredders. The company has recently contacted the following additional dealers: Goggin & Mills, 407 So. Dearborn St., Chicago, Ill.; Louis Mardaga, 710 Park Bldg., Pittsburgh, Pa.; J. Y. Riffe, 811 Peoples Bank Bldg., Charleston, W. Va.; S. D. Calloway, 3029 Roanoke Rd., Kansas City, Mo., and Brown, Fraser & Co., Ltd., 1150 Homer St., Vancouver, B. C.

The Hartmann Mfg. Co. has established a small plant at 1460 Havenscourt, Oakland, Calif., for the manufacture of tools, jigs, dies and for light manufacturing on contract. The company is also equipped to manufacture a type of washing machine at a rate of about 200 a month. A. H. HARTMANN is owner and manager.

Factory additions and employment of approximately 100 additional people will result from a reorganization of the Melaun Mfg. Co., 144 East Morris St., Indianapolis, maker of metal stampings and a variety of other metal products. The company has been recapitalized at $100,000. HERMAN H. MELAUN, with the company ten years, will continue as president. HARRY E. STEINER will be vice-president in charge of sales. LON R. SMITH, automotive engineer, will be secretary and treasurer. He has been sales executive for the Herculex Motors Corporation for the last two years.

The National Steel Corporation has announced completion of its $36,500,000 rebuilding and expansion program, when the last unit of its new Great Lakes Steel Corporation plant at Detroit, a 10-in. bar mill, is placed in operation. Completion of the program consolidates National's position as the sixth largest steel producer, with ingot capacity of 2,000,000 tons and finishing capacity of 2,200,000 tons of steel.

The Pioneer Pipe Co., 634 Townsend St., San Francisco, Calif., has commenced the remanufacturing of used pipe, valves, casing and fittings. The company will also job, export and retail and wholesale new pipe, casing, valves and fittings. GEORGE P. ALEXANDER is president and general manager.

The General Drop Forge Co., Inc., 1738-1756 Elmwood Ave., Buffalo, N. Y., has appointed Copeland-Daniels, 2842 West Grand Blvd., 503 Curtis Bldg., Detroit, Mich., to represent General Drop Forge in the State of Michigan, northwest section of Ohio and Northern Indiana.

The Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., has announced the appointment of Erskine & Rosche Co., Minneapolis, Minn., as a manufacturer's representative in that territory. W. H. ERSKINE is director of sales of the latter organization.

The Dayton Airplane Engine Co. has obtained control of the American Aeronautical Corporation through an exchange of stock. Assets of the companies total $2,603,412, and operations will be concentrated at Port Washington, L. I., N. Y.

The Vermont Foundries, Inc., a new company which will manufacture castings, has been incorporated following the purchase of the Vermont Snath Co. foundry by the Jones & Lamson Machine Co. and the Fellows Gear Shaper Co.

The Winchester Repeating Arms Co., New Haven, Conn., has sold its fishing reel manufacturing business to Horrocks-Ibbotson Co., Syracuse, N. Y. Inventory will be taken to determine the price.

The Timken Bearing Co. has received a $400,000 order for bearings for equipping new Pennsylvania electric locomotives.

The Central Tool & Machine Co., 705 Centre St., Brockton, Mass., has begun production.

The Cleveland Planer Co. has received an order from the New York Shipbuilding Co. for a 72x72 in. x 32 ft. openside planer, which when completed will weigh about 140,000 lb.

Homer Strong & Co. henceforth will sell the Gisholt line of tools in western New York.

PERSONALS

ARTHUR ANDREWS, managing director for the past two years of Burton, Griffiths & Co., Ltd., Montgomery St., Sparkbrook, Birmingham, England, has accepted the chairmanship of the company, a position recently vacated by A. H. POLLEN (*A.M.*—June 18, 966d.). F. W. TURRELL, already managing director of the Birmingham Small Arms Co., and B.S.A. Tools, Ltd., of the firm's associated companies, takes over active control and will be assisted by E. C. FARRELL, who becomes sales director.

W. C. BESCHORMAN, vice-president of the National Lead Co., New York, is on a business trip to England, France and Germany.

SAMUEL D. FITZSIMMONS, for many years plant engineer of the Brown & Sharpe Mfg. Co., Providence, R. I., has become vice-president of the Narragansett Electric Co., Providence.

L. S. HAMAKER, advertising manager of the Republic Steel Corp., was made manager of sales promotion effective Aug. 1, with headquarters at Youngstown, Ohio.

A. H. LANDWEHR, president of the Holland Furnace Co., Holland, Mich., since the organization of the company in 1906, has been named chairman to succeed C. M. MCLEAN, who died recently. C. H. LANDWEHR will succeed his brother as president. He was formerly vice-president and general manager. E. G. LANDWEHR has been named first vice-president.

MAXFIELD PEASE, who recently resigned from the Dravo-Doyle Co., Pittsburgh, has poined the Automatic Cone Valve Co., Chicago.

ARTHUR F. STANLEY, formerly with Stanley & Patterson, Inc., has joined the Parr Electric Co., Inc., 77 Warren St., New York, N. Y.

GUY WAINWRIGHT, an official of the Diamond Chain & Mfg. Co., Indianapolis, has been elected secretary of the board of directors of the Indianapolis utility district, which will have charge of the operation of municipally owned utilities in the city.

WILLIAM W. WEST, general superintendent of the Elyria (Ohio) Division, Steel & Tubes, Inc., Cleveland, for the past ten years, and previous to that time superintendent of the mills and roll shop, has resigned.

E. B. WOLF has been added to the Detroit office of the Despatch Oven Co., 622 Ninth St., Minneapolis, Minn., to assist in the sales of equipment in Eastern Michigan and Northwestern Ohio.

OBITUARIES

PHILIP TELL DODGE, 80, president of the Mergenthaler Linotype Co., New York, N. Y., for 37 years and also president and chairman of the board of directors of the International Paper Co. for 11 years, died Aug. 9 at Rye, N. Y., after an attack of bronchial pneumonia.

PROF. ARCHIBALD BARR, 76, inventor, with PROF. WILLIAM STROUD, of the naval range finders, died Aug. 6 at Milngavie, Scotland. He had also done considerable development work on various types of machines.

ROBERT MANLY GAY, 63, president of the Gay Mfg. Co., 114 Liberty St., New York City, manufacturer of air separators, died Aug. 3 after an operation in Morristown, N. J.

THOMAS R. HUGHES, 29, an engineer for the American Waterworks & Electric Co., New York, died Aug. 2 at St. Joseph, Mo.

HARRY P. SHRIVER, vice-president and production manager of the Kennedy Mfg. Co., Van Wert, Ohio, died recently.

CLINTON PAUL TOWNSEND, 63, vice-president of the Union Carbide & Carbon Research Laboratories, Inc., Long Island City, N. Y., an official of the Union Carbide & Carbon Corp., and a director of many other American or foreign firms, died Aug. 4, at Great Neck, N. Y., after an illness of 10 months. Mr. Townsend was a partner in the firm of Byrnes, Townsend & Potter of Washington. He was vice-president and a director of the Allied Process Corp., and held directorates in the Bakelite Corp. of Delaware; Bakelite, Ltd., in England; the General Bakelite Co., and the Research Corp. of 405 Lexington Ave., N. Y. C.

WALTER F. WALKER, founder and president of the American Skein & Foundry Co., Racine, Wis., died in Chicago, July 22, from a heart attack. He established the business in Racine in 1905 to manufacture wagon skeins, but had lately been manufacturing other products, including lifting jacks for railroads.

MEETINGS

SOCIETY OF AUTOMOTIVE ENGINEERS
National aeronautic meeting, Sept. 1-3, Hotel Statler, Cleveland. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

INTERNATIONAL ASSOCIATION FOR THE TESTING OF MATERIALS
First Congress, Sept. 6-12, Buildings of the Swiss Federal Polytechnicum, Zurich, Switzerland. C. L. Warwick, secretary-treasurer, A.S.T.M., 1315 Spruce St., Philadelphia, Pa., or W. H. Fulweiler, A.S.T.M. representative on the Permanent Committee, Chemical Engineer of the United Gas Improvement Co., Philadelphia.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
First fall meeting, Chicago, Sept. 17, Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

NATIONAL METAL CONGRESS AND EXPOSITION
Exposition on Commonwealth Pier and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Meetings of American Welding Society and American Society for Steel Treating in connection. Information from W. H. Eisenmann, secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS
National production meeting, Detroit, Mich., Oct. 7-8. John A. C. Warner, secretary, 29 W. 39th St., New York.

SOCIETY OF INDUSTRIAL ENGINEERS
Annual meeting, Pittsburgh, Pa., Oct. 14-16. George C. Dent, secretary, 205 W. Wacker Drive, Chicago, Ill.

NATIONAL SAFETY COUNCIL
Twentieth Annual Safety Congress, Chicago, Ill., Oct. 12-16. W. H. Cameron, secretary, 20 North Wacker Drive, Chicago.

GRAY IRON INSTITUTE
Fourth annual convention, West Baden Springs Hotel, West Baden Springs, Ind., Oct. 15-16. J. Arthur Tuscany, secretary, Terminal Tower Bldg., Cleveland.

AMERICAN MANAGEMENT ASSOCIATION
Industrial marketing conference, Hotel Statler, Cleveland, Ohio, Oct. 21-23. Headquarters, 20 Vesey St., New York, N. Y.

STEEL FOUNDERS' SOCIETY OF AMERICA, INC.
New York meeting, Oct. 22. Granville P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
National transportation meeting, Washington, D. C., Oct. 27-29. John A. C. Warner, secretary, 29 W. 39th St., New York,, N. Y.

AMERICAN MANAGEMENT ASSOCIATION
Annual convention, New York, N. Y., Nov. 17-19, devoted to the general theme of Coordinated Industrial Planning. Headquarters, 20 Vesey St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

FIRST NATIONAL EXPOSITION OF MECHANICAL HANDLING EQUIPMENT
Grand Central Palace, New York, N. Y., Nov. 30-Dec. 5. Charles F. Roth, secretary, Grand Central Palace, New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Calif., Los Angeles—Crown-Willamette Paper Co., 839 North Spring St., awarded contract for a 1 story, 199 x 315 ft. factory and office at East 12th and Evergreen Sts. $300,000.

D. C. Washington—Standard Oil Co. of New Jersey, 241 Pennsylvania Ave. N. W., awarded contract for the construction of a 6 story, service station and office at 201-227 B. St. N. W. Estimated cost $1,250,000. Noted Feb. 19.

Ga., Atlanta—Southeastern Greyhound Lines will soon receive bids for the construction of a 1 story bus station at Carnegie Way and Spring St. Estimated cost $40,000. Adler & Schutze, 1330 Candler Bldg., Archts. Noted Oct. 30, 1930.

Ill., Metropolis—Artman Lumber Co., plans to rebuild sawmill destroyed by fire. Loss $50,000.

Ind., Indianapolis—Grinslade Construction Co., 607 Peoples Bank Bldg., will build a service station at State St. and Pleasant Run Blvd. Estimated cost $40,000. Private plans. Work will be done by owner's forces.

Ind., Jeffersonville—M. Fine & Sons, awarded contract for the construction of a 50 x 115 ft. factory at Spring and Ohio Sts. Estimated cost $40,000.

La., New Orleans—A. M. Lockett & Co., Ltd., Q. & C. Bldg. (pipe line engineers), awarded contract for the construction of five buildings for factory, each 1 story. Estimated cost $100,000.

La., Shreveport—Constructing Quartermaster, will receive bids until Aug. 28, for four air corps double hangars, warehouse and assembly shop.

Mass., Boston—D. Macaulay, 436 Atlantic Ave., awarded contract for the construction of a 1 story machine shop and blacksmith shop. Estimated cost $40,000.

Mass., Brighton (Sta. Boston) — Dept. of Public Buildings, will receive bids until Aug. 25 for the construction of a 1 story garage at police station. Estimated cost $40,000. Private plans. Noted Aug. 6.

Mass., East Boston (sta. Boston)—Commonwealth of Massachusetts, National Guard, will receive bids about Aug. 15 for the construction of a 1 and 2 story, 180 x 200 ft. air corps building including hangar, engine shops, garages, etc., on Porter St. here. Estimated cost $250,000. C. F. Springall, 50 Park St., Malden, Archt.

Mass., Springfield—City, received lowest bid for addition and alterations to 3 story technical high school at Elliott and Spring Sts. from L. S. Wood, 14 Stockbridge St. $289,000. E. C. and G. C. Gardner, 33 Lyman Sts., Archts. Noted July 23.

Mass., Worcester—Sewer Dept., City Hall, will receive bids until Aug. 19 for the construction of a 2 story workshop and storehouse at East Worcester St. yard. Estimated cost $160,000. R. C. Gorrani, 175 Green St., Archt. Noted July 30.

Mich., Detroit — Chrysler Motor Car Corp., Massachusetts Ave., Highland Park, awarded contract for the construction of a 1 story, 192 x 240 ft. factory for the manufacture of automobile parts and assembly of automobiles at Mount Elliott Ave. and Lynch Rd. Noted July 30.

Mich., Detroit — Mechanical Handling Systems, Inc., 3454 Denton St., mnaufacturers of conveyors, awarded contract for the construction of a 1 story factory. Estimated cost $100,000.

Mich., Detroit — Tool Shop Hardware Co., 463-65 Michigan Ave., plans to rebuild part of plant destroyed by fire. $50,000.

Mo., St. Louis—Bd. of Eduction, 911 Locust St., is having plans prepared for a 3 story, 400 x 509 ft. high school including laboratories, etc., at Kingshighway and Arsenal St. Estimated cost $900,000. E. T. Friton, Bldg. Comr., c/o Bd. of Education.

N. J., Bordentown — Airway Express Corp., c/o W. A. Kiermann and L. S. Kaplan, 33 West State St., Trenton, Archts., plans a new airplane hangar including machine shop, etc., here. Estimated cost $75,000.

N. J., East Rutherford — East Rurtherford Syringe Co., 75 Mozart St., will receive bids about April 1932 for the construction of a 2 story, 30 x 70 ft. syringe factory. Estimated cost $40,000. J. T. Camlet, 26 Piaget Ave., Clifton, Archt. Noted June 25.

N. J., Newark—G. M. Griffith, 54 Lyons Ave., will build a 1 story addition to factory at 39-41 Hamilton St. Estimated cost $40,000. Private plans. Work will be done by separate contracts.

N. J., Newark—Weldon Roberts Rubber Co., 18 Oliver St., awarded contract for alterations to factory at 361-65 6th Ave. Estimated cost $40,000.

N. Y., Astoria—Queensboro Dairy, 42nd St., is having preliminary plans prepared for the construction of a 1 and 2 story garage and service station, office, etc., at 41st St. and 35th Ave. Estimated cost $40,000. R. Shutkind, 147 4th Ave., New York, Archt.

N. Y., New York—Dept. of Hospitals, Municipal Bldg., plans the construction of a 2 story, 122 x 174 ft. garage, storage building, etc., at Welfare Island. Estimated cost $150,000. B. R. Swartburg, 2 West 46th St., Archt.

N. Y., New York—Dept. of Water, Gas & Electricity, Municipal Bldg., will receive bids in late fall or winter for the construction of a service building and garage at 155th St. and St. Nicholas Ave. Estimated cost $70,000. J. E. Kleist, 25 West 45th St., Archt. Noted July 9.

N. Y., New York—J. S. Kahn, 285 Madison Ave., plans the construction of a 3 story, 92 x 100 ft. service garage at 537 West 20th St. Estimated cost $115,000. W. Shary, 22 East 17th St., Archt.

N. Y., New York—P. J. Kennedy & Sons, 44 Barclay St., awarded contract for alterations to manufacturing and storage building at 12 Barclay St. Estimated cost $40,000.

N. Y., New York—Sidlo Realty Corp., c/o L. Silver, 391 East 149th St., awarded contract for the construction of a 2 story, 50 x 140 ft. service garage at Webster Ave. and Mosholu Parkway. Estimated cost to exced $40,000. Noted June 22.

N. Y., Warwick — Commissioner of Social Welfare, State Office Bldg., Albany, awarded contract for the construction of twenty-five buildings and service connections at New York State Training School for Boys here. Noted June 25.

Ohio—Dept. of Public Welfare, Columbus, plans an election to vote $7,500,000 bonds for rehabilitation and extensions at various state institutions to include cottages and equipment, officers and employees building, industrial building, administration building and chapel and additional unit in power system at Hawthornden Farm, Cleveland State Hospital, Cleveland; cottages, remodeling industrial building, etc., at Longview State Hospital, Cincinnati; addition to cottage, industrial building, boilers, stokers, etc., at Massillon State Hospital, Massillon; chapel and school building, industrial buildings, etc., at Institution for Feeble Minded, Orient.

O., Cincinnati—Schell Leather Goods Co., 1015 Race St., awarded contract for the construction of a 2 story, 100 x 100 ft. factory on Central Parkway. Estimated cost $40,000.

O., Cleveland—City, D. E. Morgan, City Mgr., is having plans prepared for a 1 and 2 story repair shop and garage at Clark and Pershing Ave. Estimated cost $50,000. H. Kregelius, 504 City Hall, Archt.

O., Cleveland — Smolensky Valve & Fitting Co., M. Smolensky, Pres., 1931 West 47th St., is having plans prepared for the construction of a 3 story, 40 x 100 ft. factory and warehouse on Broadway. Estimated cost $40,000. Private plans.

O., Toledo—Sheets Elevator Co., 6529 Broadway, Cleveland, awarded contract for a 2 story factory, distribution plant, etc., here.

Pa., Philadelphia — Dodge Steel Co., State Road and Hellerman St., awarded contract for a 1 story foundry.

Pa., Philadelphia—Filler Machine Co. Inc., 1246 Montgomery St., manufacturers of canning machinery and parts, awarded contract for a 1 story addition to machine shop.

R. I., Providence—State Board of Public Roads, State House, awarded contract for a 2 story, 100 x 120 ft. maintenance headquarters building at Okie and Arline Sts. $58,826. Noted Aug. 6.

Va., Charlottesville — Dixie Flying Service Inc., Wood Field, plans to rebuild hangar building, shop, etc., recently destroyed by fire.

Wis., Eau Claire—Johnson Machine Works, 611 Menomonie St., has work under way on addition to machine shop. Estimated cost $25,000.

Wis., Madison—U. S. Dept. of Agricuture, Washington, D. C., rejected bids opened July 21, for the construction of a 6 story, 277 x 469 ft. forest products laboratory building here. Holabird & Root, 333 North Michigan Ave., Chicago, Ill., Archts. New bids Aug. 11. Noted June 25.

Wis., Neenah — Valley Sheet Metal Works, awarded contract for a 1 story, 60 x 120 ft. addition to plant.

Wis., Racine—Bd. of Vocational Education, will receive bids until Aug. 17 for a 4 story, 62 x 122 ft. addition to school building on Center St. Estimated cost $250,000.

Ont., Hamilton—Canadian National Railways, Montreal, Que., plans re-erection of machine shops here recently destroyed by fire. Estimated cost $100,000. C. S. Gzowski, Montreal, Ch. Engr. (Const.).

Equipment Wanted

N. Y., New York — Bd. of Transportation, J. H. Delaney, Chn., will received bids until Aug. 21 for furnishing and installing machine tools and equipment for 207th St. shops of Independent System of City-owned Rapid Transit Railroads.

B. C., Nanaimo—Extension Lumber Co.—interested in prices on complete equipment for saw mill destroyed by fire. Loss $100,000.